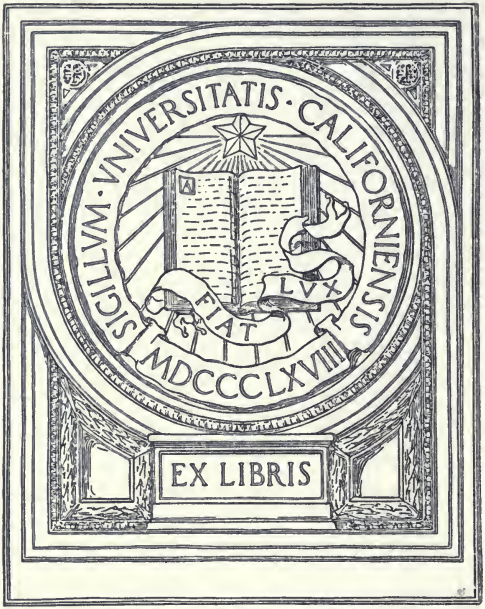
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California Garden-Flowers,

Shrubs, Trees and Vines

BEING MAINLY

Suggestions for Working Amateurs

BY

E. J. WICKSON

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"There's not a pair of legs so thin, there's not a head so thick,
There's not a hand so weak and white, nor yet a heart so sick,
But it can find some needful job that's crying to be done
For the glory of the garden glorifieth every one.

"Oh, Adam was a gardener, and God who made him, sees
That half a proper gardener's work is done upon his knees,
So, when your work is finished, you can wash your hands and pray
For the Glory of the Garden that it may not pass away!
And the Glory of the Garden it shall never pass away!"

—*Rudyard Kipling*

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PREFACE

In the hope of assisting others to attain greater joy and satisfaction in the common growing of flowers, which he has himself courted as an avocation from other weightier horticultural affairs for more than thirty-five years, the writer gathers suggestions from his own experience and enriches them with his observation and study of the work of others who have also enjoyed the advantage of pursuing their garden activities in California.

Flower-growing includes a wide range of activity. On the one hand it may lay hold upon a wealth of natural plant-beauty and behavior and win for its votary, in the public eye, the semblance of a botanist. On the other hand flower-growing may become so thoroughly engrossed with artificial standards of size, variegation and floriferousness and use so freely the agencies and materials which promote them, that its successful operator may almost seem to be a manufacturer.

Both of these lofty extremes of flower-growing are equally beyond the reach of this writer. He has never seen a "wild-garden" which gave him any of the joy of a ramble in the woods or on the hillsides or meadows. Even the same plants jumbled together could never suggest to him that a corner of a back yard had the slightest approach to wildness. The plants lack natural pose, or a corner of the fence intrudes, or a domestic cat jumps out of the aquilegias or something else always discloses deus ex machina. For this reason, although free use of California native plants will be emphasized, the reader will find herein no suggestion of a "wild-garden," nor of flowers grown in a wild way, nor of a botanist with his notebook and tinware—nor of anything else which the ordinary reader might mistake for science of any kind.

And the same attitude will be observed toward the other extreme of flower-growing—the manufacturing art. No attempt will be made to describe the way "florist flowers" are grown. In this case the writer has no prejudice. He has no objection to blossoms of colossal size nor to promotion of variation or abundance by heat, special fertilizers and fine arts of handling, which are the business capital of the florist. Nor does he object to intensive culture in the open air, such as trenching, double trenching, etc., by which a man is ordered to make deeper excavations for a bulb or a root, than were required for the foundations of his cottage. All these things are laudable in their way, but they are the properties of the professional gardeners, who manufacture flowers either for the trade or for the home use of

wealthy amateurs, who employ them. The writer is not affecting to conceal these things from the public; he does not know them as a teacher should know things.

Thus the writer avoids the perilous heights of science whence the botanists continually bring unique and beautiful plants for common use and dispense accurate knowledge of all plants which is of great value. Thus also he avoids the miry lowlands, where the florist works with acres of glass, tons of heating iron, and pyramids of fertilizers to create monsters, which save amateurs from too great conceit in their own achievements. Between the two lie the mesas of moderate effort and moderate investment upon which anyone, with a love for it can grow in California, through the whole circle of the year, by the square foot or by the acre, as his available space may be, flowers to delight his heart, to comfort his wife and to educate his children. Great as is California in her endowment of nature's handiwork in flowers, great as is the opportunity she offers for striking achievements in the higher arts of flower-growing, unquestionably her greatest gift to her people is active participation with them in the common growing of flowers for the environment of such homes as most people can secure. It is to the promotion of this great benefit and joy that the writer aims to minister.

The reader is advised that the effort to prescribe certain varieties of popular flowers as the best of their kind is systematically avoided. There are three reasons for this restraint on the part of the writer: first the same varieties are not best in all localities and the writer is trying to advise broadly for the state; second, selection of best varieties is a matter of taste in hue and form and therefore a matter of individual judgment; third, in the constant effort for improvement, old favorites are always likely to be dethroned. The reader should always keep pace with improvements in flowers he loves, by study of his neighbors' newer plantings, by attending floral exhibitions and by reading periodicals and florists' announcements. All enterprising florists do what they can with new varieties and can usually show you many of them in bloom. It is usually from the commercial establishments that the amateur must secure information of the varieties which are at the time standard in his district and of novelties which he should add to his trial lists.

E. J. WICKSON.

University of California, Berkeley, 1915.

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PART I: CALIFORNIA CONDITIONS.

CHAPTER I.

INTRODUCTORY.

California has grown superb flowers ever since creation. Following that event the local growth of plants was observed to be so fine that California was among the sites proposed for the Garden of Eden. Other considerations were, however, against us. It had been decided that the course of empire should move with the sun—westward. To secure westward movement of a race of beings planted on the west coast of a continent would necessitate the creation of creatures with an original aspiration for fins rather than for wings, which would change the plans for a birthplace of the human race, from a garden into an aquarium. Because of such difficulties California was not chosen for the Garden of Eden, and a less beautiful site in Asia was decided upon, since men could trail out in all directions from their birth-place, and, having circled around enough to test their legs, finally strike out upon the great pedestrian excursions which led stragglers to the shores of narrower oceans which they could conveniently cross, while the great central movement westward through Europe had an open course upon dry land. Those who had zealously advocated California as a site for the Garden consoled themselves with the reflection that after all it is not what is given a man at the beginning, but what he finds for himself that satisfies him. The wisdom of this thought now clearly appears. The race has proved so forgetful of Eden that no one knows now exactly where it was, while California stands clear in the eyes of the world as the point most desirable to attain for the fullest joys of living.

And yet, in spite of such a concession that, according to the prevailing opinion of mankind, California missed the location of the Garden of Eden, there is still ground for contention that we amply possess it. Prof. Edward Robertson, of the University of Chicago, claimed recently that Eden was not intended to have definite bounds. "It is evident that the whole narrative is a figure of speech," says Professor Robertson, "enshrining the doctrine of an irresponsible and sinless state in which man was created, whence he passed into one responsible and sinful. From what we can gather, there appears to have been no definite location of the garden in the mind of the narrator. His pleasure garden is an ideal locality." The argument seems to be that every man can have a Garden of Eden under his hat if his heart is right, and one can have no dispute with that doctrine. But that does not at all dispose of the real existence of such a place; in fact it only makes it surer, not only that there was such a place, but

that there is still such a place. The whole argument of the Chicago savant strongly affirms that there was and is a Garden of Eden and that it was and is in California—as our real estate literature clearly contends.

Obviously this Edenic discussion is intended for the purpose of indicating the present relation of California to the other abodes of mankind. The world at large developed California at the point where the greatest ocean separates the east from the west. From California the reversal of the westward course of empire—the return-flow of civilization—must proceed. California first paid her debt to the world in gold; since then California has rewarded the world's confidence by producing a new type of mankind, a new point of view, a new phase of literature, a new freedom of thought, a new conception of enterprise. Incidentally California has also enriched the world with new plants, new ways of growing and handling plants in industry, new installation of plant-beauty in the heart and in the home.

California's Natural Endowment.—Having thus determined the main fact of California's floral endowment from creation's dawn to the present day, the writer must deny himself any attempt to picture that endowment. Such effort belongs to our poets, painters and botanists, and they have very successfully pursued it, for our California literature and art-work with flowers is very creditable to a state so young in history, though so old in beauty. But though the writer takes fright at the standards of poetry and art, it is interesting to note briefly a few California publications which treat of the arrangement, culture and botany of the plants which this publication holds in view.*

California's natural endowment of flowers seems to have amply satisfied the aboriginal inhabitants, nor did their successors, the Spanish and the Mexicans, undertake much in garden-making. The padres who established the Missions had ample fruit gardens, but they did little with cultivated flowers—probably because the wild flowers were so varied and abundant.

Enrichment of Our Flora.—With the settlement after the gold discovery in 1848, however, a new floral era dawned in California and there was received from all parts of the world an endowment of skill in floral arts and of floral sentiment. In the ranks of the pioneers there came flower lovers and skilled culturists from all parts of the United States and from the whole breadth of the old world from

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* "Gardening in California: Landscape and Flower," by John McLaren, San Francisco; "Garden Book of California," by Belle Sumner Angier, Los Angeles; "Gardening in California," by W. S. Lyon (out of print); "California Wild Flowers," by Parsons and Buck, San Francisco; "A. Flora of California," "Flora of Western Middle California," "Trees of California," and "Silva of California," by Dr. W. L. Jepson, Berkeley; "A Yosemite Flora," and "Studies in Ornamental Trees and Shrubs," by Dr. H. M. Hall, Berkeley; "The Golden Poppy," by Emory E. Smith, San Francisco. These books, so far as now available, can be secured through the Pacific Rural Press of San Francisco at publishers' prices.

PLATE 1: "ON LEVEL SURFACES WALKS MUST BE PREVALENTLY ON STRAIGHT LINES TO BE REASONABLE"
PAGE 48.

Ireland eastward to Japan. Since then, the accessions to our cosmopolitan population have included those who have heard flower lore in all the tongues of men. Nowhere on earth, probably, has there been such a gathering of devotees to floriculture, bringing the choicest plants from the utmost confines of the planet. The writer is not aware that full enumeration of California's acquisitions of exotic plants has ever been undertaken. It is, however, clear that it would disclose an astonishing aggregate. Dr. F. Franceschi, formerly of Santa Barbara, made the following statement in 1900:

"Santa Barbara is known at present all over the world as the place where the largest number of plants from widely different climates have congregated to live happily together, and often will thrive with more vigor than in their native countries. At the beginning of the new century it is safe to say that there are grown in the open at Santa Barbara not less than one hundred and fifty different species of palms, about the same number of conifers, fifty species of bamboo, about three hundred vines and climbers, and, in addition, something like two thousand different species of trees, shrubs and perennials. They have convened here from the hottest and from the coldest as well as from the temperate regions of the globe, and they combine to make a display of vegetation that has no rival anywhere."

Since the above statement was written introduction has continued and present figures are much in advance of those cited. Wealth and taste have extended the exotic flora of the Santa Barbara region as perhaps no other similar area in California has been enriched. But of course wealth is not needed to secure beauty; taste and effort are the essentials.

DEVELOPMENT OF FLORAL INTEREST.

During the early decades of American occupation, however, ornamental horticulture received scant attention except in the suburban pleasure gardens and parks of the pioneer cities and in the few private gardens of the time. These were wonders to visitors, but their lesson to all California home-makers was slowly learned. Rural scenes for many years included inhospitable cabins or ranch houses, their weather-beaten sides environed by corrals, or by dilapidated sheds and barns, their chief door-yard ornaments being farm tools and machines soaking in the rain and bleaching in the sun, and their borders colored with discarded cans and broken crockery —pictures of unthrift and desolation.

Notable changes in the landscape, and in the environment of rural homes, came with the upbuilding of the fruit industries. The beauty of the areas of fruit trees and vines began to win the eye from the neglect of the house-yard, and the newer outbuildings were usually trim and inconspicuous. More recently the influence of well-cultivated fruit areas has been to develop neatness and good culture in the house-gardens. It is

common now to see around rural homes thrifty blooming plants adapted to the localities, good hard roads and walks, following lines of convenience, and wide lawns or stretches of low shrubs connecting the home-buildings with the environing vineyard or orchard expanses or with alfalfa fields, extending to the edge of sight. Still there is room for much wider prevalence of these desirable rural scenes.

It is desirable also that there should be disseminated a higher and truer conception of floral worth and beauty, and a better knowledge of what are the best flowers and how best to grow them. It must be acknowledged that grand and continuous as is the bloom which our benign climate and generous soils give to even the most careless grower, our knowledge of floricultural art and our practice thereof are still inferior. If such intensive culture were given here as is practiced in the most advanced distant regions, where they do wonders in spite of great difficulties in soil and climate, the improvement of our garden flowers would carry them so far beyond their present state that we could hardly recognize them.

Many influences are strongly working toward a wider and truer appreciation of excellence in rural and suburban surroundings. The very praiseworthy work of women's clubs, the introduction of horticultural studies in the public schools, the continuous exhortation of agricultural speakers and writers, the multiplication of floral festivals, and the commendable enterprise of seedsmen and nurserymen—all these and other agencies are extending knowledge of rural improvement and stimulating desire for the enjoyment of it.

Our State Flower.—A fitting token of the prevalence of floral interest and enjoyment in California is the character of the flower adopted as the floral emblem of the State. By Act of the California Legislature, approved March 2, 1903, the golden poppy (*Eschscholtzia Californica*) became the state flower of California. The flower was chosen to queenship by the State Floral Society at a duly announced election a decade earlier, the poppy securing a pronounced plurality over all rivals for the honor. The choice was ratified by local floral societies and enthusiastically accepted by hosts of organizations and individuals, by their use of the emblem in their publications, their insignia and their decorations. Botanists and travelers have declared the choice one eminently fit to be made because of the occurrence of the plant in every part of the State and the fact that every day in the year, in some region or another, its bloom can be found, casting a glorious golden glow over even the most desolate places, transforming wastes of sand into grand stretches of color wherever a shower gives the narrowest chance of growth, or spreading a larger, deeper orange bloom over our richest soils in the fullness of the rainy season.

Common consent has proclaimed the beauty of the poppy expressive of the chief interests of the State—the gold of the mine, the gold of the grain field, the gold of the orchard, the gold of the dairy—are all typified in the

glorious petals of the flower. Jewelers have patterned their finest work in gold and gems upon its graceful outlines. Artists have vied with each other to reproduce its beauties. Architects and mural artists have shown by their works that no flower is its superior either in foliage or bloom for their decorative metamorphoses. Production and trade have seized upon its charm to adorn their illuminated labels and trade-marks. In short, proceeding from regular coronation by the highest constituted authority in the State in floral lines, all through innumerable popular endorsement of the initial proclamation of her floral majesty, the golden poppy came to be every inch a floral queen, and was already secure in the popular heart when declared by legislative act to be the chosen floral emblem of California.

Individualize The Home Place.—And now that we have a state thus fitly and beautifully symbolized it is desirable that each home-maker should choose a name and emblem for his own home-place and nothing is better than some natural object which he admires or some cultural achievement which has given him joy and satisfaction and which is characteristic of his particular place upon the earth. Everyone should know that the State favors the choosing of a name for the home-spot and protects the choice. This is the California law as approved on March 9, 1909:

"Any person may adopt a name for any farm or estate owned or leased by him, and register it in the manner provided for the registration of trade marks. Such registration shall have the same effect as the registration of a trade mark.

"Any person selling or marketing the products grown on any particular farm or estate may use the name of such farm or estate as a trade mark on such products in the same manner as provided for other trade marks, and subject to the same rights and duties."

Thus the great State of California recognizes the fact that its future rests upon the home, which every good citizen delights to honor.

CHAPTER II.

CLIMATIC CHARACTERS AND ADVANTAGES.

Wherever you choose a home in California, you will not be denied the joy of flower-growing. This joy may be conditioned upon knowing what flowers to grow and how to grow them, but whoever shirks the mastery of such knowledge, either does not know that joy or does not deserve it. Elaborate analysis of California climates is not essential to the purposes of this writing because it is intended to avoid all considerations of commercial floriculture. In other horticultural works, which the writer has undertaken from the point of view of profitable production, the general characters of California climates are sketched and local modifications and their effects upon plant growth, are described with some detail.* These characters are also related to the growth of flowering plants and in choosing locations for commercial production of bloom or seed must be most seriously considered, but the amateur should resolve to grow every plant which gives him satisfaction, rejecting after trial those which refuse to accept the conditions which he provides. It is for him to derive advantage from every plant he attempts to grow, his successes give him joy, his failures give him wisdom. And then, failures and successes with plants are often so near together that some little art of protection or culture may lift a plant from one category to the other and reward him with the consciousness of triumphant discovery.

Therefore, it is not well to try to decide theoretically exactly what flowers to grow in any place, but rather to try whatever you admire. Least of all is it wise to reject plants because some local wiseacre may declare: "them plants don't do nothin' here." At the same time, of course, each of the many local climates of California does have its limitation in adaptation and one can often escape disappointment by adopting the conclusions of earlier resident planters—providing their success with some plants assures you that they really have plant-love, intelligence and industry and that they have fairly demonstrated the ill-adaptation which they confide to you. Still the writer is skeptical and perverse enough to urge the amateur not to accept such conclusions too readily. There is such a knack of doing things aright in point of time and method, that plants sometimes accept gratefully conditions generally held to be adverse and reward successful efforts most generously. And there is such satisfaction and joy in it. This writer is always alert and sympathetic when, in his wide rambling

* "California Fruits and How to Grow them," chapters 1 and 2; "California Vegetables in Garden and Field," chapter 3; Circular 121, University of California Experiment Station.

through the state, he receives an appeal like this: "Won't you come and see my balsams, my neighbor told me they would not grow here."

Find Out When Nature Will Work With You.—Probably no single cause of failure with plants in California is more prevalent than doing things at the wrong time. In the varying conditions of heat and of moisture in soil and air, which characterize our local climates, there are right times and wrong times for all gardening operations. These times do not coincide with best times for doing things in other states or countries, nor are they synchronous in different parts of this state. Probably every garden calender correctly made anywhere in the north temperate zone will work out right at some point in California—at some degree of latitude, at some distance from the ocean or at some elevation above it. This means that, so far as natural conditions are concerned, we can do everything that can be done in the temperate zone, the world around, but disappointment will follow the attempt to widely use any one of these remotely-made calenders, while to apply them one after the other, or to calculate the resultant or mean of all of them, ends in appalling confusion.

This is not wholly a fanciful conception: it may be counted almost historical, because that is the way the pioneers from all lands endeavored a generation ago, to determine what should be California's horticultural practice. Although some of them failed in all ways they knew, and all of them failed in some ways, there were a number of methods and policies which demonstrated their suitabilities by their results, which for size, abundance or duration of foliage or bloom yielded satisfaction beyond expectation and gave encouragement so marked that failures were accepted only as suggestions to work in other ways. Hence arose the supreme confidence in California which was the ruling spirit among our pioneer horticulturists and found expression in the common saying: "Well, California is different.", which signified superior—if you can master the way of it.

And so during the first decade of her history as an American state, practically every plant considered desirable in civilized countries was brought for trial in California and every cultural method known in such countries was practiced on our soil. Since then the same natural action has been repeated continuously by later comers who do not know that nearly all their bright ideas of desirable plants and the culture of them were anticipated by the pioneers. But even this is desirable; because, aside from the individual satisfaction of it, there has been reached a better understanding of local conditions of soil and climate and of culture requirements of plants to meet these conditions, than could have been otherwise attained: better and broader, probably, than any practicable scheme of heavily endowed systematic experimentation could have secured. And the conclusion of the whole matter is that there is no place in California where soil sits

and water falls or flows, in which a home need be bare of beautiful foliage and flower: that there is no local climate, be its distinctive character desert fire or mountain frost, which does not cherish lovely plants, that between these extremes, each of which sets its own limits on plant growth, are the great expanses of California valleys and foothills, throughout which perennial mildness prevails in such varying degrees that broad leafed evergreens may rule the landscape in one place and be practically absent in another and yet the tenderest deciduous and herbaceous perennials be seasonably safe in both—and have a growing season each year about thrice the duration of their dormancy.

What the Wild Plants Think of California.—There are two ways in which we can demonstrate the horticultural quality of the climates of California by reference to the plants themselves.

First.—Continuing the Edenic suitability of California suggested in the preceding chapter, it may be claimed that the native plants by their superior numbers of unique and characteristic species testify the appreciation in which this state is held in the plant world. Of course we must go to the botanists for interpretations of such evidence. Dr. W. L. Jepson of the University of California has said this:

"California is one of the botanical sub-provinces of the earth which is remarkable for the number of endemic species which it contains. The California area, perhaps the Sonoran-zone part of it, has been a vast breeding ground for species. Of the 4000 species in California, probably about one-third are endemic in the California area; Great Britain, with half the area of California has about 1400 flowering plant species and not one of them indisputably endemic. Scandinavia, with about twice the area of California has 1380 flowering plant species and very few endemic. The region covered by Gray's Manual of Botany (east of the Mississippi, from Tennessee northward to Hudsons Bay), has 3413 species against 4000 in California, with only one-sixth of the area.

"There is greater degree of relationship between the flora of the Pacific Coast and Europe, than there is between the flora of the Atlantic Coast and Europe. The relationship of the California flora as a whole are more strongly with the European Mediterranean flora than that of any other region. While there are practically no species in common the number of generic types and orders in common is very considerable and very significant in character." *

Thus it appears that the native plants testify to our wide variations in climates, which range from Alpine summits to the shores of sunlit seas, and the botanical resemblance to the Mediterranean flora includes

* In part from an address before the Sigma Xi society, Berkeley, February 25, 1914 (unpublished).

of course the Riviera and all the earlier exemplars of etheral mildness of which poets, prophets and historians have testified since the birth of the race. Thus again we approach the Edenic argument.

What Introduced Plants Declare.—In adducing the testimony of the plants to the horticultural adaptations of our California climates, there come the introductions of man as supplementing creative distribution, therefore—

Second.—The instance given in the preceding chapter of the collections of exotics at Santa Barbara is a token of similar achievements, in varying degrees, in other parts of the state. This fact is apparent to any distant person who may read the lists of plants offered by our nurserymen for planting in the open air—for they are largely the growths prescribed for green houses in all wintry parts of the world. It is also clear to any appreciative visitor, even be he unskilled in plants, who notes for a moment the wide range of hues and forms which can be seen wherever any attempt has been made to indulge in ornamentals. Our conditions lie in that most happy climatic region known as the sub-tropical, or semi-tropical, where we may install, for superior growth, the characteristic vegetation of the temperate zone, add to it a wealth of new forms and colors from the borders of the strictly tropical region, and draw from even beneath the equator itself plants which thrive there upon certain elevations. It is true, of course, that California cannot afford an out-door home for plants which thrive only in the humid heat of the tropical coasts, but we have little reason to mourn our limitations in this respect. We gain more from our affiliation with ordinary temperate latitudes than we can possibly lose by our unfitness for plants from tropical jungles.

What the Plant Grower Should Try to Learn.—Although the climates of California are so strikingly suitable to plant growth, as the plants themselves declare, it must be admitted that there are great variations of conditions within narrow distances which the plant grower must try to learn—largely by observation of plant behavior, because it is very difficult to adequately determine them otherwise. Contrasting climatic conditions are so intimately interwoven into the soil-cover of the state that they defy the geographer to depict them. For example, on the floors of valleys conditions may develop widely along contour lines, but on the edges of valleys they are almost superimposed for a little distance through the quick rise of hill or mountain side. Above these, there may reappear contrasts like those of the valley floor which they look down upon, and then rising again only a few hundred feet perhaps one may come into an area where no broad-leaved valley evergreen is safe. And such differences, though not perhaps to the degree intimated, are discernible on individual properties which rise from valleys over adjacent hillsides to mountains

that a single owner may have practically all the climates of a county on his own place—each with its own favors and hardships for garden plants.

It becomes then unquestionably imperative that the intelligent grower of plants shall know his climate, shall choose his plants and modify his cultures to meet the conditions which that climate imposes. It is true to say that to grow flowers in California one must know California. It is more exact to say that he must know that particular piece of California upon which he proposes to produce and enjoy the beautiful.

What the Grower May Do.—But lest it may be inferred from the foregoing remarks that the writer prescribes choice or rejection of plants strictly according to local conditions of heat, frost and moisture, the fact must be emphasized that knowledge of local conditions is satisfactory and valuable to the possessor not as a warning to avoid plants so much as to enable him to successfully cherish them—for the reasons cited at the opening of this chapter.

Although it is practicable, from the point of view of the amateur, to effectively modify by artifice nearly all the natural conditions of temperature, moisture, soil, texture and fertility, as will be described in following chapters, and thus cause his situation to produce garden plants to which it may have only partial natural adaptation, there are still a few general characters of California climates which make the effort to modify natural conditions much easier and cheaper in one place than another, and these should be sketched in as a back ground for the action in culture modifications which the amateur will enthusiastically undertake. Naturally the writer seeks data for general characters from those who have made closest study of the subject, and the following notes are compiled from the studies of California climatology by Alexander G. McAdie, who in 1913 became Professor of Meteorology in Harvard University, after about twenty years service as director of the U. S. Weather Bureau in San Francisco.* Prof. McAdie is however not to be held responsible for this presentation of his conclusions. The writer has adapted them to his present purpose and has indulged in interpolations which perhaps will surprise most of all the scientific author whose words are, as we may say, floridified.

Why We Have So Many Climates.—The groups of meteorological phenomena which are popularly designated as the "local climates of California" are produced by certain great causes, modified in their effects by topographical conditions. These great determinative causes proceed from the Pacific Ocean on the one hand and from the great

* "Climatology of California," U. S. Weather Bureau Bulletin L, 1903; "The Rainfall of California," University of California Publications in Geography, 1914.

mid-continental plateau on the other. Areas of greater or less atmospheric pressure appear both over the ocean and over the plateau and strive with each other for the joy of looking down upon the beauties of California—pushing, jostling and pursuing each other alternately over protecting mountain barriers and wooing the modest maiden, with heat or coolness, smiles or tears as are the fitful moods of ardent lovers.

Why Our Climates Are So Mild.—Fortunately the suitor from the ocean usually holds the points of vantage. Prof. McAdie says:

"It is because of the general motion of the air from west to east that the climate of west coasts is less severe than the climate of east coasts. If the circulation of air were reversed, the Atlantic coast and the middle portion of the country would have their temperature extremes much reduced and the climate would be in many respects milder than that which now exists. On the other hand, the climate of the Pacific coast, and especially of California west of the Sierra, would lose much of its present equability. The winters would be rigorous and the summers very warm."

As it is, the prevailing winds blow over a surface that is warmer in winter and cooler in summer than a land surface would be. During the summer the mean temperature of the ocean water is 60°, and during the winter 50° F.; while probably the extreme temperatures of interior land-surfaces of the continent would frequently range more than 50° lower in winter and as much higher in summer—and would produce in California extremes against which the ocean is now our enduring protection.

Causes of Local Variations.—But though these general causes are always in operation and always formative, it is still true, as Professor McAdie says:

"In the diversified topography of the state we have perhaps the most important factor in determining local climates. The state has a mean length of nearly eight hundred miles and an average width of two hundred miles. Its area is a little less than a hundred million acres. The coast line corresponds in position with that portion of the Atlantic coast extending from Boston to Savannah. The California coast line has a mean annual temperature ranging from 50° to 60° F., while on the Atlantic the ranging is from 47° to 68°. In the winter the difference between the mean annual temperature of the interior of California and the coast is only about 5° F. but in summer the difference is more marked, amounting to about 20° F. The prevailing westerly winds, wherever allowed access to the interior through gaps in the Coast Range mountains, modify and practically control the temperature,"—being however excluded from time to time, for short intervals, by winds from the interior which surmount the Sierra and

flow downward over its western or southern slopes. These winds are hot and dry, or cold and dry, according to the season of the year; as they traverse snow fields in winter and sun-baked plains in summer, before entering the area of California.

Opposite in direction, source and character are the southerly winds of the rainy season which bring ocean temperatures from the southwest while the storm-centers advance from the north, according to the cyclonic movement of storms.

All of these and other general phenomena, together with more localized phenomena of down-flow and up-rise of air, according to its temperature, and other conditions of frost occurrence, the times and amounts of rainfall, the force of the winds and their content of moisture vapor—all these are influenced or determined by topography as involved in elevation, exposure, and relation to adjacent features of environment and are to be expressed in terms of plant growth through experience.

Certain Plants May Define Our Climatology.—It seems possible that at some future time the vast and varied area included in the state of California may be subdivided or districted by the success or failure of certain plants, according to a scheme of life-zone. This has in fact been proposed and entered upon with indifferent success thus far because the exotic plants included in the effort were distributed largely by commercial impulse to grow them and therefore the use of them as standards of natural suitability went astray. Though the observed thrift of a plant might be demonstrated, the absence of another plant might be rather due to unprofitability than to lack of adaptation. Nor does the botanical scheme of distribution serve the plant grower any better purpose for wild plants are often very safely carried beyond their chosen habitats by horticultural arts of irrigation or protection. Still it is possible that at some future time some one may gain possession of enough knowledge of plant requirements and of gardening arts to produce a horticultural map of California which will designate districts of actual and potential equivalence more intelligibly than they can be expressed in isobars and isotherms. And yet it may be expected that these lines will approach meridians of longitude rather than parallels of latitude, just as our isobars and isotherms do, because our climatic equalities run roughly northward and southward, as do the coast line and the mountain ranges which are factors in their production.

Elevation and Ocean Influence.—The two regulating factors in a local climate seem to be elevation (both above sea-level and adjacent plains) and modification of ocean influence by distance or by intervention of great barriers. If it were simply a matter of elevation, contour lines would easily define our districts but lines of adaptation

may cross contour lines—going westward when a coast mountain barrier is unbroken, and eastward when a gap in this barrier occurs, because the exclusion or admission of ocean influences tend generally toward the reduction of summer heat and winter cold.

But a tendency toward equality in temperature does not secure the best results from all plants. For example the free access of the ocean temperatures in the coast district of the upper part of the state denies oleanders, Cape jasmines, etc., the high summer temperature which develops their freest flowering, while it does give heat enough for grand blooming of geraniums, camellias, etc., with which the winter temperature does not interfere. Thus a district outlined on the basis of full suitability for the Cape jasmine might exclude the geranium from territory in which it glories in summer and draw it into places where it would need winter protection. If outlined on the basis of the geranium or the camellia, it would bring the Cape jasmine into some regions in which it would be a sorry sight because of undeveloped blossoms, while if outlined on the basis of the camellia it would disregard the weakness of both the Cape jasmine and the geranium. Thus a few common plants are used to indicate differences which are narrow by the thermometer but still determinative of degrees of satisfaction to the grower from the point of view of all-the-year hardiness and best blooming. Many other plants could be used to illustrate the same differentiation in local climatic conditions and all of them would still be counted tender or semi-tropical from the point of view of a wintry climate.

The Grower's Attitude.—It is hoped that the instances which have been cited will demonstrate the fact that division of California into districts of equal suitability to flowering plants is exceedingly difficult even if it should some day be shown to be possible to some edifying degree. Until such guidance is available, the only reasonable advice which can be given to the amateur is: "prove all things, hold fast that which is good." Learn from observation of older plantings of trees and shrubs which have received fair treatment, learn from current experience and observation the behavior of herbaceous plants which interest you. Maintain a fairly critical and discriminatory attitude and a high standard of excellence, above all, do not deceive yourself by regarding a thing of the best quality simply because it is of your own growing.

Absolute Elevation May Be a Barrier.—In all speculations concerning the suitability of this or that situation in California for the growth of the flowers which you enjoy, two general facts are comforting and suggestive. First, California climatic conditions are as a whole very favorable, as has already been suggested: second, defects or ill-adaptations are, as a rule, slight and capable of modification by

simple garden recourses, because the extremes are not great departures from conditions which all except strictly tropical plants either fully enjoy or tolerate. This is true of the coast region generally, of the great valleys of the state and the mesas and foothills which lie between the valleys and the mountains. On the mountains and in mountain valleys or plateaux, where elevations above sea level are from 3500 to 6000 feet, wintry snowfall and zero temperatures necessitate the choice of plants and pursuit of cultural policies generally characteristic of the north temperate zone. In such regions many suggestions conveyed by this publication are apt to be misleading.

SUMMARY OF ADVANTAGES

In many following chapters there will be suggestions of the characters of California climates in terms of garden policies and methods. Briefly it may be stated that the climatic advantages which the California gardener enjoys, except in the mountains which are high enough to be wintry, include the following:

A growing season which includes the whole year for broad-leaved evergreens, except those of strictly tropical origin, and many of them have a winter blooming habit which contributes immensely to the continuous floriferousness of the year.

A growing season in which frost is so rare and light that many deciduous perennial plants of wintry regions become evergreen and continuous bloomers or have so short a dormant season as to be practically evergreen: some annuals assume the perennial habit or repeat their blooming.

A frostless season, except in very high or low places, which is practically twice or thrice the length of the frost-free period of wintry climates—giving tender plants proportionally longer flowering season and superior development.

A growing temperature during the rainy season which permits glorious winter-gardening even in locations where summers are too dry for flowers through lack of irrigation.

Absence of cyclones, which renders arbors, pergolas and other garden structures of very light construction, safe and satisfactory.

Absence of hail-storms, except in the mountains, rendering plants free from pelting and green-houses safe without hail-stone insurance.

Dry air during the summer, rendering high temperatures practically free from depressing effects.

Last, and perhaps best of all, the joy of living and working with flowers all the year with weather which invites open air activities. Let then our Dr. F. Franceschi give us a physician's certificate of that, in these words of his:

"One thing more than any other that dominates the physical and mental being is climate. The delights of atmospheric conditions, where neither heat nor cold obtain, affect most favorably the physical and mental condition. The body revels in a sense of painless enjoyment, and the mind, freed from the depressing influence of an uncomfortable body, has the whole realm of existence for a pleasure ground."

By her arid semi-tropical endowment California escapes the trying conditions of both the tropics and the frigids. This is a fact to which the many who have sought California homes from all parts of the world continually bear witness.

GARDEN MODIFICATIONS OF CLIMATE.

It may be readily inferred that in climates naturally so kind to plant growth, modification, for cultural purposes could be slight and easily affected. This is absolutely true as to the operations of the working amateur, for he has such a breadth of activity with plants needing no artificial heat that he is but seldom prompted to provide it except in the simple ways outlined in Chapters IX and X. Of course the commercial grower and the occasional amateur, whose taste requires orchids and the like must have temperatures under complete control and production—just as the same interests are served in other climates, except that the result is far more easily and cheaply secured. But with that we have nothing to do in this book. Our suggestions are restricted to conservation of natural heat, either by direct use of trapped sunshine or by indirect use of sun-heat through checking loss of it by radiation from the earth. But even these elementary affairs have been so effectively developed in commercial fruit growing of California that they present themselves with a wealth of detail which cannot be fully presented in this connection.* For ordinary garden use these suggestions may be helpful:

Higher heat during day time and escape from a freezing temperature at night, may often be secured by planting windbreaks of trees in hedge form or as shelter belts traversing the direction from which cold winds may be expected to blow in. Glass screens or lath fences serve the same purpose for small areas. The height should be proportional to the area to be protected. A hedge or screen ten feet high may amply protect a small garden, belts of tall trees will be needed for an area of several acres.

A few plants may be saved from frost by spreading over them a cover of cloth, paper, carpet, rush-mats, lath frames, etc. These act by holding ground heat from radiation, and will be effective against several degrees of frost continuing for hours.

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* Discussion of achievements in this line are found in publications by the U. S. Weather Bureau and by the California Experiment Station.

Plants can be protected from freezing by freely wetting the ground around them, by running water alongside in a ditch or by placing a bucket of water close to the plant. This is effective against four or five degrees of frost for an hour or two. The protection is secured by the latent heat set free by the cooling of the water.

Plants can be saved from injury by freezing by the building of fires of damp litter on the windward side so that a cloud of smoke envelops them during the low temperature. This is also effective against four or five degrees of frost for several hours. The action is two-fold, first by checking radiation—second by preventing touch of sunshine which may cause rupture of tissues by too rapid thawing. A slow rise in temperature may permit slow thawing without rupture, if the freezing has not itself been hard enough to break the tissues. The same result is obtainable by drenching with cold water, plants which have been lightly frosted. Obviously this must be done before sunrise.

Plants may be protected by direct action of heat from brush fires, fires of inflammables in small pots or stoves, etc., which have shown ability to raise the heat of the lower layer of the surrounding atmosphere six or eight degrees, under favorable conditions of air movement which does not replace the warmer air too rapidly. This method of "heating all out of doors" was first proposed and reduced to successful operation in California by the growers of citrus fruits. It is of course available for the protection of all tender plants. Wiring areas for protection by heat from electric lamps is also practicable but apparently more costly in outfit and operation, but invention in this line is still in progress. Manifestly one can wire a garden for illumination and night enjoyment and at the same time provide for frost prevention.

CHAPTER III.

SOILS AND FERTILIZERS.

No matter what the soil surrounding your home may naturally be, you can grow glorious flowers—if you will try to understand what the soil has to do for your plants and what you must to to prepare it for its work. Probably not one amateur in a thousand selects his building place because of the natural suitability of the soil to produce an environment of flowers, shrubs, trees and vines. He rolls his eye over the landscape; he basks in the sunshine; he makes sure that he can quench his thirst from well, ditch or pipe-line; he listens for the gong-clang of the trolley car. If all these prospects are pleasing, he builds his house and stakes out his garden. From the points of view of the amateur, the performance is thoroughly rational, because whatever the soil may lack he can make up to it, in fact, if he has no soil at all he can haul it in or make it on the spot.

For these reasons, although a good depth of suitable soil is indespensable in a commercial plant-venture of any kind, and though it is very desirable also for the purposes of the amateur, its absence does not deny the possession of a good garden and full enjoyment of it. And, this being true, it is rational for the amateur to attach relatively less importance to buying soil than to buying other good things. For example a soil-less site, out of fierce winds and sharp frosts, will give more pleasure than a soil-full site, which is within reach of either of them. If then nature has at some remote period before California secured her present climate, blown away, or washed away or pushed away with a glacier the good soil substance from a ridge into a flat below, the ridge poverty may still be better for the amateur's garden than the soil-wealth of the flat. This will not always be true and we are not trying to make a rule that an amateur must buy rocks or hardpan in preference to good soil. We are trying to enforce the fact that there is no single rule and that, under certain conditions, one may be wise to attach more importance to other things which please him than to the soil, because soil can be made or modified and that in floral gardening the soil in its natural condition is seldom accepted as fully satisfactory, though it may be the best on earth. The moral of this homily, therefore, is that one should not deny himself the joy of flowers, nor should he inflict upon the public eye a shabby place, with an excuse that the soil is not good. If it is not good, make it good.

The Nature of Soils.—In order to improve the soil from a floricultural point of view one should secure some measure of understanding of its nature and functions. It is hopeless to expect full knowledge,

for the composition and activity of soils constitute one of the most complex subjects with which science has to deal, involving chemistry, physics, botany and bacteriology in some of their most subtle manifestations. Man has not yet attained mastery of soil science and is now striving for full understanding more strenuously and with better research equipment than ever before. Still many things are sufficiently understood to serve as a guide in soil improvement and to make the teachings of experience more intelligible than hitherto. The reader should study some recently written treatise on soils of which there are many available and all of them edifying along the line of elementary facts and principles most directly affecting practical work.

Perhaps the most helpful conception the amateur can get of the soil is that it is a sphere of action, of agencies, materials and forces analogous to the activity in the atmosphere. One must not regard the soil as merely "dirt"—a mass of dead matter, inert except as a growing plant may lay hold upon it or push it aside. The soil is full of activities which are modifying its components and characters and qualifying it to actively minister to the growth of plants not merely to tolerate it. These activities are very numerous and have directly to do with the ability of the soil to render its proper service to the growth of the plant. A few may be mentioned to indicate their indispensability:

1.—Mechanical changes in soil particles; granulation induced by earth insects, burrowing animals, tillage and chemical changes.

2.—Chemical changes in soil contents; induced by reactions, fermentations, humus formation, nitrification, etc., by bacteria.

3.—Air movement; distributing oxygen, nitrogen, carbon dioxide, etc., for plant nutrition, directly and indirectly.

4.—Water movement; employing the physical forces of gravity, capillarity, absorption, evaporation, etc., generally for the advantage of the plant, but sometimes otherwise.

Suggestions of the action and inter-action of such agencies and forces as these should lead the amateur to soil study and careful observation of facts encountered in his experience.

Horticultural Aspects of Soils.—Generally speaking it may be said that suitability of soils for horticultural uses is determined by two distinct groups of characters or conditions: first, the physical or mechanical; second, the chemical. When we speak of "heaviness" or "lightness," "coarseness" or "fineness", "tightness" or "looseness", etc., we refer to the physical characters. When we speak of "richness" or "poorness", "fertility" or "sterility", we refer to the chemical character. In a general way it may be said that the physical characters help the plant to grow, the chemical characters furnish it something to grow with, one may be called "plant-support", the other "plant-food."

PLATE 2: "CLOTHES LINE POSTS FOR PILLAR ROSES, CROWNED WITH BASKET CAPITALS OF IVY GERANIUM"—PAGE 48.

It is clear then that both groups of characters are essential to success with the plant, from a horticultural point of view and that the two groups are closely inter-related.

The Physical Characters.—All the physical characters of the soil are horticulturally best when they occur in moderation and worst when they occur in extremes. Two extremes in soils, for instance, are clay and sand and intermixtures of the two, in connection with various forms of organic matter, give all the degrees of variation in soil texture. If the soil contains much more than 25% of clay it becomes a heavy clay soil and physically less fit for most horticultural uses. If it contain less than 4% of clay it becomes almost clear sand. The best horticultural soils are silty loams which have proportions of clay within the limits stated—with sand and finer particles sometimes called rock powder, and organic matter to form the bulk of the soil. Fortunately California has this most suitable mixture largely predominating in her soils naturally and this constitutes one feature of the splendid horticultural adaptation of California.

There are various reasons why such a physical condition of the soil promotes the most satisfactory growth of plants. First, water capacity: which in such soil is ability to hold water equal to from 30 to 40% of their bulk, and they also have a coefficient of hygroscopic moisture (moisture which cannot be taken away by air drying) of 3 to 7%. This assures about the right degree of moisture retentiveness for the best plant growth.

Second, permeability: the association of fine and coarse particles being such that air and water enter freely and without such sufficient access there is less thrift to the plant and less bacterial action to furnish food for it.

Third, penetrability: the same mixture of soil particles renders it easy for plant roots to extend freely and deeply to render strong support to the plant mechanically and to enable it to reach supplies of plant food and moisture. Too much clay prevents free root growth, too little clay prevents moisture retention and is apt to bring the plant into distress unless the most exacting measures are taken to supply moisture constantly in the right amounts.

After the condition of the soil in the foregoing respects is found to be suitable for horticultural uses, the next physical character is the depth of soil available to the plant. Depth means not only that the plant shall have room for root extension and a large amount of plant food within reach but depth is also directly concerned in moisture retention as a sufficiently retentive soil with frequent surface cultivation acts as a subterranean reservoir. Depth is directly related to the growth habit of different plants. Our common garden plants use from two to four feet of soil though they may thrive on less, and

shrubs, vines and fruit trees extend their roots to a depth of from four to twenty feet or more in the deep free loams which are found in many places in California. If however moisture and plant food are furnished artificially in about the right times and amounts, very thrifty growth can be had on much less depth of soil. This we see both in garden and in green house.

It is a part of horticultural art also to improve the soils with what it has to deal, also to make soils artificially which shall exactly meet the needs of different plants. Upon the possibility of this art rests nearly all of our green house work and very close imitations of ideal natural soils are produced by the mixture of loaf mold, sand, peat and other fibrous materials which are known to progressive plantsmen, and which will be discussed later.

The Chemical Character.—The other chief division of soil character involved in horticultural success includes the chemical conditions and components. Plant food in abundance is a prime requisite and it must be present either naturally or by the intelligent contribution of the horticulturist.

The first need of soils in the arid region is usually humus, which is produced by the decay of organic matter. Humus not only is a source of nitrogen which the plant needs, but it adds to the moisture-holding power of the soil.

California soils are as a rule rich in lime but the heavier soils are improved by the application of lime and become more friable, better suited to root growth and easier in cultivation.

Potash is also abundant in most California soils, but may often be applied to advantage. Phosphoric acid is oftenest in small supply and this material seems to minister directly to flowering and fruiting of many plants. In efforts toward enriching California soils fertilizers containing nitrogen and phosphoric acid should be first used and their effects are usually very marked and satisfactory.

SOIL IMPROVEMENT FOR GARDEN PLANTS.

The foregoing outline indicates in a general way the conditions to be aimed at in soil manufacture or improvement for ordinary amateur purposes and suggests the chief materials to be used, viz.: clay, sand, organic matter, according to the soil characters desired. A composite substance which is usually mentioned in prescriptions for amateurs is "garden loam." This has no particular character but may approach uniformity of condition from the fact that it generally means the common soil of the locality ameliorated by tillage and free use of farmyard manure for a number of years. In the newer parts of California there is seldom any "garden loam" to be had, except in the scattered market-gardens or in the corrals where animals have been kept for a number of years. In such a case, after removing the impacted cover

of clear manure, one is apt to come to the old surface soil which has had leachings from the manure, has been mellowed by the action of earth worms and has about the right composition for garden loam, except that it may be soured from lack of aëration and may lack lightness because of the absence of fibrous material. It does, however, form a good foundation for a garden mixture if associated with sufficient amount of other materials.

Sometimes one can find a loam deposited by overflow of creeks or streams, or held in their beds by growth of willows, etc.—choice alluvial material, granular and mellow, although the region be one of hard soils generally. This is a good basis for a garden mixture. But in most cases, the home-garden maker must begin with whatever soil-cover his premises naturally have and he can surely turn it into most satisfactory garden soil if he is willing to take the trouble.

In nearly all cases the problem in garden soil improvement consists in making it more light or porous; freer in taking water from cloud, hose-nozzle or ditch; more permeable and mellow under the spade or hoe and disposed to maintain a granular condition and neither baking nor crusting on drying after rain or irrigation. In a few cases this operation will consist in transforming a clay into a loam, but generally in changing from a heavy loam to a light loam, because usually a soil which is called "adobe" is a clay-loam and not a clay soil. In a few cases, too, the problem may be to change from soil which is too sandy to a condition of greater retentiveness. This is the easiest transformation possible, if one works aright, because sand is a most beneficent foundation for a garden, although all are scripturally warned against building a house upon it .

In addition to the natural loam cited above, there are several materials which have been mentioned from time immemorial as desirable components of garden soils, viz.: sand, barn-yard manure, leaf-mold, or other fibrous substances which may be substituted for it. Their several functions will be briefly characterized:

Sand.—The chief function of sand is to separate and hold apart from too close contact, the other finer particles of which the soil is composed. It promotes the movement of air and water and facilitates all the activities belonging to these movements as indicated on page 24. It also promotes the operation of the soil qualities, mentioned on page 25. To accomplish this the sand should be "clean" or "sharp" when secured for soil mixtures, because these characters render it more efficient in the role chosen for it. One can use to advantage sand which contains fine silt or clay powder if it is locally abundant, but if one has to buy or haul sand for its specific uses it should be washed clean of fine powders and its grains should be sharp or angular. Such sand as builders choose has these characters. Sand may be

washed by subjecting it to heavy rains or it may be washed with a hose or a small stream of water—the point being to run away the fine particles with the flow of the water. Both fine and coarse sand are useful, but the latter is preferable—especially when sand is used for propagation, as will be described in another chapter.

Various granular materials may be used for the purposes which sand serves, for they act in the same way though not to the same degree, and are therefore inferior.

The writer has made a practice for the last twenty years of using on flower beds all the sifted coal ashes taken from the house fires. Coal ashes by themselves have no appreciable fertilizing value. They do, however, have a very good effect if the cinders are sifted out and the ashes which go through a quarter-inch mesh screen are dug into a heavy soil. They make the soil more friable and overcome its tendency to bake. We used the screened ashes as an absorbent under the hen roosts and they went to the garden with a fertilizing quality. Coal ashes are not harmful unless used in such large quantities that the soil becomes too loose and porous.

Old plaster from house repairs and the refuse left in house building, is good for garden use, tending to mellowness in two ways: by the action of the lime (which will be mentioned presently) and of the sand. It has always been considered a good dressing for garden land. It is also a corrective of sourness but is much less active than fresh lime, but it acts in the same way to a limited extent. It can be freely used if the land is heavy and needs friability; but should be well scattered.

Sawdust and fine mill shavings and old spent tan-bark are also desirable in disintegrating heavy soils. They are not worth consideration as a fertilizer, because they are so difficult of decay, even when in the soil, and if the soil is light and loose in character it is apt to be rendered much more so by this addition. In a heavy soil the addition of a limited amount of fine shavings renders it more friable, but they should be well distributed through the soil; masses of them generate fermentation and mildew, which may injure rootlets of plants.

Farm-Yard Manure.—Precious to the plant-grower as a complete food for plants and as an agency to improve the texture both of heavy and of light soils, is the manure from farm animals; cow manure being preferable for general garden uses and horse manure particularly for hot beds, as will be stated in another chapter. Farm-yard manure should be thoroughly decomposed for garden uses—unless it be in starting a garden on a heavy soil, when considerable quantities even of fresh manure can be deeply plowed or dug into the soil at the beginning of the rainy season, when considerable amounts of water may be expected to enter the soil for several months. Fresh manure should

not be used on sandy soils, nor is it suited for near-surface uses on any soil. Rotting the manure in plank bins or covered pits which cannot fill with water is accomplished in a few months, if moisture is added to regulate fermentation. If it is allowed to become too dry in a mass it will "burn out" and become almost worthless; if it is too full of water, air will be excluded and decay will be prevented. Manure can be very successfully rotted in open piles on the ground surface, if it is forked over from time to time to equalize the temperature and sprinkled to insure adequate moisture for fermentation. This operation also breaks up the masses and gives a finely comminuted material, practically free from offensiveness and available for use on open ground or in potting and propagating operations. Such manure in great quantities is the price of full satisfaction in flower-growing, even if the soil is naturally good; it is indispensable in any effort to make a good growing soil artificially. The enthusiastic amateur comes almost to have affection for good manure—the effect of it is so magical. It was a genuine sentiment which caused a flower-loving, suburban amateur to reply to her husband who asked her what gem he should buy her for her birthday: "Well, John, if you don't mind, I would rather have you buy two loads of Smith's best manure; it would give me more pleasure." And undoubtedly this pleasure was realized, for Smith had the knack of rotting manure and delivered a light chocolate-colored, fine grained material which made the plants jump and, as it was in a suburban situation, he was able to get gem-prices for it. Such things the working amateur can do for himself if he keeps a cow as a part of his garden machinery; if not, he must put money in it.

If it should not be practicable to put the manure through the composting process during the dry season, it should be spread out in the corral during the summer and allowed to dry quickly. Manure which is broken up and dried in the sun does not lose fertility; it is only when it is piled and allowed to ferment that important constituents are lost. If the corral is cleanly scraped at the beginning of the rainy season it can then be spread for fall covering-under to decay in the soil or it can be piled and watered for composting and it will come into prime condition for use before the end of the rainy season.

The manure of other farm stock does not serve exactly the same purpose because it has less fibrous materials and does not act upon soil texture in the same way. Animals of more complex diet also produce manure of more concentrated quality, capable of killing plants if used too freely or if too much is collected in one place. Poultry manure, free from earth, contains even as high as four times as much plant food as ordinary stable manure. One way to secure distribution is to thoroughly mix the manure with three or four times its bulk of ordinary garden soil and use this mixture at about the same rate as

stable manure. There is no reason to fear the material. It is good for any plant, provided it is sparingly and evenly distributed. Similar remarks could be made about the manure of swine, sheep and goats. All are serviceable for plant food if wisely used.

Leaf-Mold and Other Fibrous Materials.—Except in forested areas, leaf-mold is not as available in California as at the east where woods and wood lots are more evenly distributed. The same is true of old grass sods which are decomposed to supply fibrous materials. Except on low moist lands, the natural grass growth in California occurs during the rainy season and is composed of annuals which are not sod or turf formers. Usually, then, the amateur has to make his own leaf mold or rely upon cow manure to furnish the fiber which acts so benignly with sand in the formation of desirable soil texture. But home-made leaf mold is not impracticable. All falling leaves should be raked up and returned to the soil. This can be done by digging them into beds or borders or they may be specially composted in a shallow pit in a corner of the garden, into which are currently thrown all rakings of leaves, lawn clippings, small prunings, weeds from walk-cleaning, spent flowering stems and even the vegetable trimmings from the kitchen, if there are no fowls to make use of them. The proper decay of all this material depends upon moisture and wetting down with the hose during the dry season is necessary. If such a pit is emptied at the beginning of the rainy season a good amount of leaf mold can be secured, of which the finer part can be separated with a screen of half-inch mesh and sacked up for use in mixtures for the seed boxes, or for potting, while the coarser stuff can be dug into the open soil. Well rotted straw will serve about the same purposes. In fact, all vegetable matter should be turned into the service of the soil; even rank weeds are usually safe, for the composting sprouts and kills the seeds. Much stuff is burned for ease and neatness which should be rotted down for plant food and fiber.

If one has no supplies of this kind, fibrous peat can be bought of the florist-supply houses. It is imported in large quantities from the peat bogs of Europe, and is a very neat, clean material to use with sand, soil and a dash of commercial fertilizer for house plants; seed boxes or other small uses.

IMPROVEMENT OF HEAVY SOILS.

Nearly all that has been said thus far in this chapter has direct reference to the improvement of heavy soils—for that is the chief problem. It should be added, however, that the first treatment of a soil disposed to bake and crack is to apply lime at the rate of one pound to each fifty square feet—just after digging, because it can then be done with only danger of burning the eyes and not both eyes and

feet. Do this in advance of a rain or wash in the lime with a good hosing. After allowing it to stand a few days give the plat a good covering of farm yard manure, say a layer two or three inches in thickness and dig again. If you are a good digger the new surface will not show either lime or manure. Then cover the new surface with an inch depth of sand and rake evenly, which will mix the sand with the soil and the plot is ready for planting. After the plants are well up from the seed or bulb, or immediately after planting, if the planting be of rooted plants, cover the surface with more manure—to be worked into the soil with the winter weeds, if the start is made early in the rainy season; or to remain on the surface as a mulch if the rainy season is near its close. This will give you a start toward mellowing a refractory soil. It should be repeated for several years until you get a full spade's depth of loam which will no longer bake hard or crack open. Liming and sanding will soon cease, but manuring will continue as long as you desire to have good flowers.

IMPROVEMENT OF LIGHT SOILS

As already intimated this is a much easier problem because it requires neither lime nor sand, but just straight, well-rotted manure, year after year. The formation of humus by the further decay of the manure enables to soil to hold faster to moisture and the increase of fibrous material knits the particles together in better texture. Sand and cow-manure, cow-manure and sand; keep at it, forwards and backwards, if you wish to get a loam that is worth its weight in flowers. Wood ashes can be used to particular advantage on sandy soil, but the coal ashes should go elsewhere; so should sawdust and all other coarse stuff. Use well rotted, fine grained animal manures: the pig, sheep and goat, with plenty of water, make a better contribution to a light than to a heavy soil, but one must be careful that the amount used is not too large. Chemical fertilizers are also more profitably employed and water, which is the greatest of all plant foods, can be safely used in large amount. It is hard to set bounds upon what can be done with a light loam and cow manure under the favoring climates of California.

IMPROVEMENT OF ALKALI SOILS

Here and there in California valleys, the home-maker confronts the problem of making ornamental plants grow on soils which contain too much of the soluble salts of soda which go under the general name of alkali. It is not easy to subdue them. The only sure way to free the soil of them consists in underdraining with tiles and using an abundance of fresh water on the surface, which will dissolve and carry away the salts with the water through the drains. If the alkali is very strong this is indispensable. If it is less strong and largely

accumulated near the surface, good results can be had by digging in considerable amounts of stable manure, rotten straw and sand as prescribed for the improvement of heavy soils above. This makes the soil friable, reduces evaporation from the surface and therefore prevents the accumulation of alkali in the upper soil where it will do most harm to plants. Use fresh water freely on a surface largely of sand and litter and quite gratifying results can be obtained with plants which are somewhat tolerant—providing the alkali in the whole soil mass is not too strong naturally or has been weakened by washing into the drains. There is much difference in the toleration of plants and everyone having to deal with alkali should keep an eye open for observation. Oleander and lemon verbena have succeeded in strong alkali, while roses perished entirely. Chrysanthemums grow moderately well and a few of the hardy annuals. Bermuda grass is most promising in lawn-making on alkali. Of ornamental trees, cottonwood, black locust, honey locust, Russian mulberry, California fan and date palms, European sycamore, eucalyptus rostrata and tereticornis, umbrella, pomegranate and tamarisk and various atriplexes are dependable for ornament and shade.

GREEN MANURING

All garden soils are improved by digging-in green plants and winter-growing weeds, clovers, grass, etc., should always be spaded under rather than cleared off, unless they are taken to the compost-heap for decaying, as has been mentioned. Tall weeds which may interfere with digging as they stand should be chopped flat, pulled into the furrow and covered in. When the rains come early or the ground is wet down deeply by irrigation in September a good covering of clover, vetches, rye or barley, etc., can be quickly grown to be dug into the soil in the early winter.

VARIOUS FERTILIZING MATERIALS

Finely-sifted coal ashes and road dust are good absorbents for manurial fluids and gases, and may be freely used for such purpose and so may powdered gypsum. Lime and wood ashes should not be so used because they set free the nitrogen compounds which are the most valuable content of manures. This action is conditioned largely upon the presence of moisture, and if the material is kept dry and hurried into the soil the loss is lessened, but there is always danger of some losses.

Liquid manure is a readily available stimulant of plant growth and is largely used by florists. It should, however, not be too strong, nor too freely used. It can be easily made of well rotted cow manure or of fresher droppings of other animals by filling a cask one quarter full of manure and filling with water from a hose which is allowed to

PLATE 3: "SOMETIMES A NEIGHBOR'S BACK DOOR IS WORTH LOOKING AT THROUGH THE SHRUBBERY"
PAGE 48.

reach down near the bottom of the cask. After settling, the water can be dipped off the top. It should have the appearance of weak tea. By shooting in more water from time to time the supply will last some time. It should be applied with a watering pot, with sprinkler removed, and directed into the soil at the base of the plant; not sprinkled on the foliage. This is safer than running the liquid manure in a trench, for one is less apt to carry around too much. Liquid manure can also be made from chimney soot in the same way.

The waste of calcium carbide from acetylene outfits can be used as lime. It has no other appreciable fertilizing value. The same is true of the refuse lime from sugar refining.

Nitrate of soda is a good plant stimulant. It is largely used by florists at the rate of one teaspoonful to three gallons of water. If used too often, it may kill the plants or cause overgrowth. Watch the plants: their appearance will indicate when to use a pushing fertilizer.

Bones, dead fowls or small animals, etc., can be turned to good account by burying at the roots of trees or shrubs of all kinds.

Special mention of fertilizing materials and policies will appear later in the discussion of the plants, to which experience has indicated their particular adaptation.

CHAPTER IV.

TILLAGE AND IRRIGATION.

The realization of full advantage from a soil of open texture and from generous fertilization, which have been strenuously advocated in the preceding chapter, is conditioned upon two things: ample moisture and good tillage. These two things are themselves interrelated, co-working toward the same ends, always aiding but never displacing each other; a well-matched team, each pulling its part of the load—sharing, equalizing and mutually distributing the burden which neither could bring through alone, although either could, perhaps, start and move it for a time. Although there are conditions under which the amateur may find himself compelled to work more strenuously with one than the other, which will be discussed later, the requisite for the best results through the longest time, if one wishes to secure the advantage of his best choice, or most generous improvement, of soil for his garden, is soil-working and soil-watering with the fullest intelligence and liberality. And this conclusion is the teaching of garden experience in California covering nearly one hundred and fifty years. Let this lesson be sketched in this way:

A Historical Demonstration.—The fields, gardens, orchards and vineyards attached to the Spanish missions which were established in California in 1769, were irrigated. The mission farmers knew no tillage except the opening of the soil in the first instance to receive the seed or the plant. When it began to grow, water was run over the surface. When the surface dried and cracked, more water was run over it. When the surface soil became a solid mass of root-fibers drawn up in the almost vain attempt to get the water which rippled over the surface, which they had rendered almost impervious, these masses were hewn out with mattocks, fresh soil put over the main roots and more water run over it, which was able to penetrate the new soil and give the main roots a new inducement to produce another outfit of root-fibers, which in their turn grew until they in turn became matted, shut off their own moisture supply and were themselves finally hewn out—this proceeding in endless succession.

When Americans took possession of California to dig for gold and the prices of food supplies became appalling, the farmers among them soon took the hint that more wealth could be had by digging for crops than for gold. The impression prevailed that the state was of no use for farming, except for stock ranging, unless irrigation was practiced as at the missions, but the American farmers soon saw that the plants would grow better if the surface were stirred at proper times and in proper ways, and they began to practice cultivation and irrigation with

results so surprising in size of vegetables and in yield of grain that reports sent to the east had to be accompanied with affidavits to secure attention, and even then not always credence. When it was demonstrated by the behavior of the plants that applications of water were not needed as frequently as the mission farmers made them, less water was used and more surface stirring undertaken and then came the discovery that plants which made their chief growth in the warm, moist, winter weather and those which rooted deeply even though they had to grow all through the dry summer, could in many cases reach most satisfactory production without any artificial application of water, if the normal rainfall was adequate and the soil retentive enough naturally and sufficiently cultivated during the growth of the plant. Thus arose in California sixty years ago the first demonstration of the principles which are now the chief asset of "dry farming" and which are sometimes claimed to be recent discoveries.

But although these early Californians did demonstrate that under certain conditions plants can be grown under scant rainfall by tillage instead of irrigation, they also determined another fact of even wider importance, viz: that irigation is not a proper substitute for tillage and that instead of being feasible to keep pouring more water to save the cost of tillage, it is required for the thrift of the plant that the more frequent the application of water the more frequent must be the tillage. Instead of a rule of "more water less tillage", which the Spanish settlers of California seemed to proceed upon, the true rule as demonstrated by their American successors is "more irrigation more tillage." This is now the accepted policy and practice in all irrigated regions of the earth whence has come knowledge of California's achievements in horticulture and the way they are secured.

The Reasons for Soil-Working With Watering.—Space is not available to explain in detail why tillage and irrigation must be always associated and keep pace with each other toward the full development of the plant and its products. A few of the reasons may be stated, however, without attempt to fully support them:

First.—Tillage opens the soil for the reception of water and is even more important for the admission of water by irrigation than by rainfall, because an irrigated surface becomes more densely and deeply compacted by the puddling action of a volume of water than by the action of rainfall, even when the latter comes in heavy downpours. In fact, soil compacted by irrigation becomes loosened and disintegrated by the action of subsequent rainfall.

Second.—For the same reason the penetration of irrigation is less than that of the same amount of water falling as rain or snow, and the consequent formation of an excessive amount of surface roots not only continually lessens this penetration but increases the danger of

drought injury and limits the plant food available to the plant by confining its root activity to a shallow surface layer of soil.

Third.—For the same reason also the aeration of the soil is reduced and this renders it less hospitable to the plant, for adequate aeration is as necessary as adequate moisture.

Fourth.—Tillage is corrective of irrigation effects upon the soil and is for the same general reasons essential to conservation of moisture and economy in the use of water, because evaporation is greater from an impacted surface which is more likely to be produced by irrigation than by rainfall.

Fifth.—The most impressive demonstration that these points are well taken is found in two conditions clearly discerned from experience: first, that the products of irrigated land on which tillage is constantly associated with the use of water are superior and more abundant than when tillage is scant or absent; second, that tillage must be stopped before the end of the summer in regions of hard autumn freezing for fear that some plants may grow too late and come into freezing temperatures with too much soft wood in the new growth. The efficiency of tillage is thus demonstrated both positively and negatively.

For these and other incidental reasons, tillage is at least equally required with irrigation as in dependence upon rainfall, and is requisite, on the whole, in larger amount because the methods of irrigation, in general practice, make it more necessary to overcome the effects of frequent applications both to maintain the soil in what is properly described as "a lively condition" and for the conservation of moisture for the good of the plant.

Why Most Important in the Garden?—Although the foregoing conditions rule in all our agriculture they are most important of all in ornamental gardening. With many plants of which the seed or the fruit is the thing desired, there may be danger of encouraging growth toward size to the lessening of weight or quality of the product, but who ever found a flower too large or a foliage plant too magnificent? Occasionally a naturist may cry "monstrosity" at the professional or home gardener for "pampering his plants" but the cry evokes no popular response. The joyful amateur will fasten in his button hole a rose as large as the crown of his hat and go forth to the admiration of his fellow men. He can get such a rose by plenty of manure, plenty of water and plenty of tillage and not otherwise—because these things make the plant most active and efficient. And the rose knows what is good also for other flowering plants. Even a cactus with a record of producing cow-feed at the rate of ninety tons to the acre has ordinary plant-sense, for it did this on land which had been tilled

and manured for twenty years or more in a region averaging over 30 inches annual rainfall. And yet the popular notion is that a cactus plant yearns for a desert!

HOW MUCH WATER AND HOW FREQUENTLY APPLIED?

These questions, which are always being asked, can never be answered. It is true that very interesting determinations have been made of the amounts of water in the substance of different plants; of the capacity of different soils to receive and to hold water; of the amount lost by evaporation or drainage under different soil textures and air-thirst but with all these factors variable it should be clear that any general formula, workable everywhere would be so difficult to understand and apply that no one could be sure of growing a plant with it. There is however a better way and that is to learn by patient observation how a plant looks when it has its best moisture supply. Amount of growth; size, substance and aspect of leaves; size and texture of flowers—all these are among the tokens which a plant given of satisfaction and the grower must learn to understand them and use water to secure them, if he has made the soil right, as outlined in the preceding chapter.

Water is the heaviest component of all growing parts of a plant and water is therefore the chief plant food. Not only so but no other nourishment can enter vegetable tissues through the roots unless it be dissolved in water. Water to waste is also the plants protection. Nothing but water can save the tender foliage from untimely blushing beneath the too ardent gaze of the sun; nothing but libations of water from the cells of the plant will save them from destruction by thirsty air. Therefore, except in a water-less region, do not try to determine how little water a plant can live upon; endeavor rather to ascertain how much water it can use to advantage and supply it if you wish to live in an amateur's paradise.

As for the frequency of irrigation that also depends upon soil, kind of plant and other variables but much also depends upon method of application and that will be suggested in discussing the work for the months of the year in Chapter XII. The aspect of the plant must be the main guide in frequency as in amount of watering, and the wise amateur will soon learn not to wait for signs of evident distress, but always to prevent them.

SOURCES OF IRRIGATION WATER.

In other places* the writer has undertaken to describe with some detail ways to get water by those whose premises are not reached by public supply, delivered under pressure. This problem may be

* "California Fruits," Chap. XV; "California Vegetables," Chap. V; Farmers' Bulletins, (U. S. Dept. Agr.), Nos. 116 and 138.

avoided in this connection because no one could exist in his garden without having previously secured his domestic water supply in whatever way is best for his situation. Water for the garden should always be included when one plans for water for the family and for the domestic animals. Probably this item is often omitted because of an exaggerated notion of the additional amount required.

Relation of House and Garden Water Supplies.—The writer's experience covering a good many years is that his total supply of water, delivered through a meter has averaged 276,000 gallons a year—of which (as ascertained by deduction for house use as determined by the consumption during rainfall months) 76,000 gallons have been used for garden irrigation. The family has averaged seven persons and nearly all laundry work has been done in the house. This would indicate that the domestic water supply of such a household must be increased 38 per cent to maintain a garden consisting of:

Lawns	3810	square feet
Beds and borders	3451	" "
Vegetables	2000	" "
Total	9261	square feet

This is the actually irrigated area—all walks, etc., being excluded. The place is of average quality, from a gardening point of view—not so good as one will have if he follows fully the precepts of this book and not so poor as he is apt to have if he neglects them. But this conclusion from experience must not be taken as contradicting the previous declaration that there can be no exact prescription of the amount of water required for garden work. The garden in question has a soil of historical adobe type although it has been mellowed into a fine loam by twenty years of manuring and the use of all the ashes resulting from the consumption of not less than four hundred tons of coal during the same period. There is however a tight clay subsoil at an average depth of 18 inches and all the water is kept within reach even of shallow-rooting plants. Manifestly much more water would be required to produce similar results over a coarse, leachy subsoil, and the same would be true with a surface soil losing largely by evaporation. The garden is also situated in a region of average rainfall of 28½ inches, with summer air prevalently cool and moist. The amount of water in this case must therefore be regarded as about the minimum capable of producing the results indicated. Perhaps a fair conclusion would be that on an average the house water supply must be increased fifty per cent to carry a fairly good garden environment.

HOUSE WASTES FOR GARDEN IRRIGATION.

It is perfectly feasible to use waste water from the house for garden irrigation if one will give proper attention to it. A cesspool

in a gravelly subsoil will dispose of its contents readily, but if it is a neighborhood of shallow wells a cesspool is always a serious menace to health. The only rational way to treat sewage is by means of a septic tank, so that its outflow may become innocuous in every-way. The following* is a simple statement of its construction and operation:

Sewage should be taken away from the house in a septic system, the most reasonable and sanitary system that there is, and one very inexpensive and easy to make. How this is arranged is shown in the accompanying diagram.

Construction.—The size of these tanks depends upon the number of persons using the system, It is usual to allow four cubic feet of space in each tank for every person using the system. Nine persons therefore will require that each tank contain 36 cubic feet of space, or to be three feet square by four feet deep. The shape of the tanks is of no special importance.

Both tanks are to be the same size and are placed side by side. The first tank is where the first great activity in sewage change goes on, but in tank No. 2 the final stage of sewage change is accomplished. These tanks are located a little distance from the house and connected with the plumbing by glazed terra cotta pipes with well cemented joints.

A cast iron pipe leads from the terra cotta into the first tank and ends in an ell which projects about 18 inches down into the tank. The outlet of this, as can be seen in the diagram is always closed by the water in the tank.

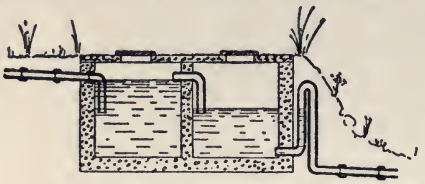
On the farther side and near the top of the first tank is another pipe leading to tank No. 2. This also ends in an ell, which sometimes is covered and other times not. The outlet of tank No. 2, however, is at the bottom, although the pipe that removes this water is in the form of an inverted "Y", with the top where the bend comes, very nearly but not quite as high as the pipe that runs into tank 2. The farther side of the outlet pipe runs down to a lower point than the level of the tanks, and from there has a gradual slope so that it goes off by gravity.

Operation.—By the time the sewage gets through the tanks it is in liquid form entirely so that the work of the final outlet pipe is merely to get rid of liquid. This outlet pipe should run along on a gradual slope until it reaches within about a foot of the surface of the ground. When it reaches this point a "Y" joint of glazed terra cotta is put in and from each arm a line of ordinary porous drain tile laid. These lines of tile must have a very gradual slope, say one-fourth inch in 30 feet. Each line should be about 30 feet long in light soil and 75 or more in heavy soil.

The tiles must be placed about a quarter of an inch apart so that the liquid will wash out between them, and rocks, shells, or some

* From a fuller account of disposal of house wastes in Pacific Rural Press of Dec. 21, 1912, and Jan. 25, 1913.

similar material placed over each joint so as to prevent the dirt from sinking in and blocking the drain. The soils will then absorb all the liquid sewage without injury to soil or sanitation.



Construction of the Septic Tank.

Bacterial Action.—It is the action of bacteria that transforms the sewage in a septic system, and these are especially active in two places, first in tank No. 1, and secondly when the sewage reaches the soil between the joints of the drain tile.

The first lot of bacteria can work properly only without air, or with very little. Thus the tanks must be always tightly closed on top. The bacteria in this tank reduces all solids to a liquid condition.

The bacteria of the drain can work properly only with lots of air, and California soils, being naturally so dry, open and well aerated, are ideal for this purpose. The second tank is needed to give the bacteria in the soils plenty of air. If the sewage should flow as it came from the house it would keep the joints of the drain all uniformly wet and it would drown out the bacteria except a few on the surface. As a septic tank discharges only about once a day the sewage has a chance to dry out in the soil, the bacteria gets plenty of air, and has plenty of time to work.

The sewage when the bacteria get through with it is, as previously stated, perfectly harmless. It also does not injure the soil, and as it contains considerable fertilizing material it is excellent for plant growth. It is entirely satisfactory to have the drain run through vegetable garden, alfalfa or orchard, provided plowing is done so as not to disturb the tile. If, however, there are trees or berry vines whose roots can get to the tile, it is very advisable to have the farther end of the drain open so as to allow a free circulation of air to prevent bunches of roots from forming and blocking up the drain.

The foregoing describes a complete system for disposition of sewage automatically and restricts the use of the water to subirrigation. It is also feasible to use the outflow for surface irrigation by means of newly made furrows which, in small operations, can be made with a hoe alongside the lines of plants which it is desired to irrigate. The outflow from tanks in proper operation is completely harmless, but has a disagreeable odor. For this reason it is not desirable to allow it to flow over the surface, but rather to allow it to run for a short time in a furrow in which it is covered with dry earth and allow to complete in the porous soil the same transformation

described as taking place in the line of porous tiles described above. In this way one can distribute the water over wider spaces, get wider irrigation use of it and guard against undesirable saturation of the soil in a restricted area.

Direct Use of House Water.—Where one has entrance to a regular city or suburban sewage system and thus avoids the expense of a septic system of his own it is still desirable to use the greater part of the house water in the garden, if the owner's time is worth less than the water and he will give the distribution of it the necessary attention. The writer usually has more time than money and he has demonstrated the feasibility of what is here commended. In planning the plumbing of his house, two outlets were arranged near together with a connecting pipe and valve. The upper outlet which was about two feet above the ground gave outflow water from washstands, bath tubs and laundry tubs; the lower outlet below ground received the flow in the pipes from kitchen sink and water closets and connected directly with the terra cotta pipe to the street sewer. By this arrangement the cleaner water could be drawn out by itself into a large hose for garden distribution and the water from other places, containing grease, etc., was immediately discharged into the sewer. By opening the valve in the pipe connecting the two outlets, all the flow from the house could be released to the street sewer, in the winter, when the garden was running by rainfall, or whenever not convenient to use the water for irrigation. In this way perhaps three-fourths of the waste water from the house can be turned into flowers, if one will observe the rule of short runs of water in a place and good hoeing as soon as the ground is ready for it.

SURFACE OR SUB-IRRIGATION.

A system of sub-surface irrigation by tiles is suggested in the foregoing discussion of the septic tank. Plans for distribution of water underground by perforated or porous carriers have been indulged in by Californians for half a century, but have never been installed by many people and have never been long in operation by the few who most enthusiastically advocated them. There is reason to believe, however, that on certain soils, distribution through simple lines of tile laid near the surface may be more satisfactory than running water in furrows. This will be for shallow-rooting plants not expected to stay long in place and where the pipes are to be thrown out and relaid at short intervals of time. The entrance of roots in such cases is not a ruling factor. The distribution by connecting these lines of tile with the water supply is easily effected, and shallow cultivation need not be interfered with. But even in such case the cost of tile enough to cover any considerable area soon reaches high figures, and the labor of laying and relaying it is also expensive. It

is doubtful whether the time will ever come when such systems and devices will replace well-regulated surface distribution and the cultivation which is associated with it, though for economy of water, and to escape the refractory condition which some soils assume upon surface irrigation, experimentation in this line certainly commends itself to those whom the theory pleases.

Distribution through tile laid upon the surface is available for shallow-rooting plants, and has been shown to be economical both of labor and water under Eastern conditions. In an arid region, however, the prevention of surface stirring of the soil is a decided objection to the system, unless the soil be very light and free from a tendency to bake. Surface applications not followed by stirring are not a substitute for cultivation, as discussed earlier in this chapter. It is a common experience of beginners that plants may dwindle and fail, though water may be almost daily poured around them, on an uncultivated surface. Each new application seems to add to the compact and inhospitable character of the soil.

GARDEN TILLAGE.

The importance of adequate soil-stirring or tillage has been urged in the discussion of the relations of tillage to soil moisture and thrift of the plant.* It will also intrude in many other connections in succeeding chapters, for tillage is the ruling art in gardening, related to all other arts and often actually determining their success or failure. Therefore no elaborate, separate discussion of tillage will be undertaken for its most important phases will inevitably pervade this treatise in all its parts. Still for connected view of so important a matter a quick, comprehensive glance at the purposes of tillage will be taken.

Tillage is the general term including all forms of soil-stirring—from light touch of smoothing rake at the surface to heavy wrench of dynamite in loosening the subsoil, and its offices may be categorized as follows:

1.—To open the soil: (a) to reception of moisture and air; (b) to receive and distribute fertility; (c) to afford fine particles for seed-enclosure and root-seizing; (d) to promote porosity and root extension; (e) to promote drying when moisture is in excess.

2.—To close the soil: (a) to break clods and reduce air-spaces in and under turned-soil, by harrow, sub-soil packer or thrust of spade; (b) to reduce surface soil to granular or "crumby" condition (and to

* Quite fully discussed in "California Fruits," Chap. XIII and "California Vegetables," Chap. VII.

keep it in that condition) to lessen loss of moisture by capillarity and evaporation, by weed-growth and by too free entrance of dry air to soil spaces.

To pursue all these purposes in detail, and the means for atttaining them, would lead to a recital of the theory of tillage and the introduction of an implement catalogue—both of which are readily obtained elsewhere, and both of which are earnestly commended because there is much profit in the individual thinking which they promote. To know the effect which you desire to secure in the soil, to recognize the condition which secures that effect and to possess the tool with which you can best secure that condition—these constitute a concrete mastery of tillage which one need never expect to manifest in his garden until after he has developed it in his own head by close watching and hard thinking, about the soil and the particular tools which best meet its varying conditions. Therefore no general exposition of tillage is undertaken in this place, nor will there be special prescription of implements. The suggestion of conditions in various relations of tillage which are discussed, will, it is hoped, be helpful toward the mastery indicated. Particular references will be found in the chapter relating to the work for the various months. The mulch as an adjunct to tillage will also be considered in that connection.

DRAINAGE.

Such free use of water as has been urged is always safer and more satisfactory if the soil is enabled to relieve itself of a surplus by natural disposition through its own free lower strata or by outlet through tiles laid at a depth of about three feet, according to methods prescribed in all publications on the subject. It must however be acknowledged that very few amateur's gardens in California are underdrained and in most cases such expenditure as tiling requires may be deferred and resorted to only if signs of real need are manifested. In this respect of course California conditions are quite unlike those of humid climates—the soils being usually much deeper and more loamy and the precipitation less. In the irrigated garden one can escape the cost of drainage by watching closely and regulating the application so that the soil does not become unduly wet. For this purpose digging beneath the surface is desirable for it is possible to have dry earth above and mud below—a condition particularly injurious to shrubs, trees and perennial vines; while herbaceous plants may enjoy it hugely if one can judge by their size and bloom.

PART II: CALIFORNIA CULTURAL SUGGESTIONS.

CHAPTER V.

LAYING OUT THE GARDEN.

The art of garden design has puzzled and charmed mankind from prehistoric times. It invaded the earliest recorded thought and since then it has pervaded all form of literature and has used nearly all human words as signs of its ideas or as descriptive of its principles, purposes and methods. Poetry, architecture, painting, sculpture, history and philosophy are its ancient hand maidens and now modern science is enrolled as its patient and admiring servitor. Its invocation in a work of this kind is as incongruous as the installation of a gorgeous rose in a tomato can—and yet it must serve our present purpose.

Out of the distant past there come to us two groups of ideas in garden design and they contrast themselves as groups under the terms, the "garden natural" and the "garden formal." Of these the first is often called the English, and the second the Italian, style. But these terms are only modern conveniences, for the principles of each trace back to most ancient prototype—the Garden of Eden and the Garden of the Pyramids. The Garden of Eden was of course a natural landscape which Adam evidently did not seriously mutilate. for the record surely indicates that he did not perspire much until after he was banished from it. The Garden of the Pyramids with its terracing, its graven images, its flights of stone steps and banks of foliage laboriously hewn straight or grotesquely curved, with its lines of walks and lawns vigorously angular and perpendicular or parallel to the walls of buildings or elaborately geometric in relation thereto—these are the things which brought moisture to the brow of the banished Adam and have involved his successors to the present day in lavish labor or expenditure for that which is not beautiful.

But it is not our purpose to arm ourselves for a conflict of styles, each of which has its place—quite well defined if one will think earnestly about them. This fact is suggested in the following sentences from the leading English champion of the garden natural:*

"Beneath all art there are laws, however subtle, that cannot be ignored without error and waste; and in garden design there are lessons innumerable both in wild and cultivated nature which will guide as well if we seek to understand them simply.

"Why is the cottage garden often a picture and the gentleman's garden near, wholly shut out of the realm of art, a thing which an

* Garden Design by W. Robinson, London, 1892.

artist cannot look at long? It is the absence of pretentious "plan" which lets the flowers tell their tale direct, the simple walks going where they are wanted; flowers not set in patterns; the walls and porch alive with flowers.

"Can the gentleman's garden, then, too, be a picture? Certainly; the greater the breadth and means the better the picture should be. But never if our formal 'decorative' style of design is kept to. Reform must come by letting Nature take her just place in the garden.

"After we have settled the essential approaches, levels and enclosures for shelter, privacy, or dividing lines around a house, the natural form or lines of the earth herself are in nearly all cases the best to follow.

"In the true Italian garden on the hills we have to alter the natural line of the earth or 'terrace' it, because we cannot otherwise cultivate the ground or move with ease upon it. The strictly formal in such ground is as right in its way as the lawn in a garden in the valley.

"I hold that it is possible to get every charm of a garden and every use of a country-seat without sacrifice of the picturesque or beautiful; that there is no reason why, either in the working or design of gardens, there should be a single false line in them. By this I mean hard lines, such as the earth never follows.

"The landscape gardener of the present day is not always what we admire, his work often looking more like that of an engineer. His gardening near the house is usually a repetition of the decorative work of the house, of which I hope many artistic people are tired.

"The soul of true gardening it to show, on a small scale it may be, some of the precious and inexhaustible loveliness of vegetation on plain, wood and mountain. This is the necessary and absolutely only true, just and fair use of a garden!"

The California Way.—These few sentences will serve our present purpose, which is to incline those who are pondering garden design toward a little deeper thinking than is usually given the matter. In California we are doing some very creditable work, and are also occasionally perpetrating something outrageous as well. So far as our observation goes, our country places are, as a rule, more praiseworthy than the suburban creations. In the suburbs the homemakers play all sorts of pranks with earth and plants. Having a moderate area of ground they can torture it in many ways without too great expenditure. In the country, at least in those parts of the State where the surface is broken and there is a natural growth of tree and shrub, some very satisfactory work has been accomplished in adding to the charms of a place while not sacrificing its natural beauties. If we have not advanced as far in instances of good garden design as perhaps might be expected of a people upon whom such wealth has been poured, we have fortunately not made many serious mistakes. There seems to be quite a general leaning toward correct taste and appreciation of that which is fitting and beautiful.

For this reason one will see in California very few trees tortured into grotesque figures from zoology or from solid geometry, nor will one see

many checker-board or pin-wheel apartments for flowering plants. Our suburban landscapes show few stiff terraces, trees and shrubs in lines of battle or other plants arrayed to reveal the hand of man as clearly as a tailor-made costume. On the other hand, our home grounds and parks display natural slopes, tree clumps, shrub clusters and flower masses arranged to suggest the work of nature and conceal the work of the designer—which is much higher art.

A very hopeful sign that the best standards of taste will prevail in the future development of the State is found in the fact that the University of California has established in its College of Agriculture systematic instruction in floriculture and home ground ornamentation, and has also provided instruction in correspondence courses which require no fees. There is also increasing in California a qualified profession of landscape architecture, both men and women being ready to furnish plans and specifications for home ground design and planting at moderate cost. Their services are very desirable, even in affairs of small area, while in larger undertakings they will notably increase the owner's joy in his improvements, for they surely can throw round the life of a man an environment of pictures, near and afar, opening vistas, veiling ugliness, and displaying plants, trees, slopes, rocks, waters—each with its own best qualities and relations.

What all these things mean, and their importance in garden design, one can learn by reading one of many books on the subject which are now available and of which, for beginners and self-working amateurs, the small treatise* by Kemp, an English garden designer, as revised by Professor Waugh, seems to us best and most helpful, both in thought and practical work. It is full of drawings suggestive of good ideas and construction details.

But though the writer has such respect for the profession of garden design and is urgent in advice to all having suburban residence or country villa sites to develop, to place their planning in professional hands, he cannot refrain from stating a few things which impress him as an amateur, for he has no professional connection whatever with the subject.

SUGGESTIONS FOR LAYING-OUT.

Among the principles to be observed, or the conditions to be secured, several may be mentioned, with concrete suggestions to render them intelligible and to support their desirability.

Everyone who undertakes to improve his own home grounds should first make a plan, or map, with pencil and paper, with an eraser to facilitate changes. The beginner will find it convenient to use cross-ruled paper indicating squares of half an inch, which may be used to represent ten or twenty feet of linear ground-distance, according to the area he desires to

* Kemp's Landscape Gardening, by F. A. Waugh, fully illustrated. Published by John Wiley & Sons. Postpaid $1.50, from Pacific Rural Press, San Francisco.

cover on a sheet of convenient size. This suggestion, which is unquestionably abhorrent to one of training or talent in drawing, must be commended to the retired merchants, mechanics, sea captains or active farmers who are improving their homes in California, and all of whom are alike at sea in tracing a course on a sheet of drawing paper. Let such a one then boldly take the cross-ruled sheet and defy the smile of the fiend who has the artistic temperament.

Making The Map Fit The Land.—The first operation is to establish connection between the sheet and the land surface which is to be represented by it. Get a boy, whose mind has not yet unfolded to art criticism, to help you and with a tape line, or the common tree planting wire, tagged with 20-foot intervals, and mark out the area with short stakes just as though you intended to plant trees at 20 feet distance on the square system. Now you have the sheet of paper and the land surface mutually representative, and you can easily count the stakes or the line-crossings from any point to make locations.

Using this method, locate on the sheet first the boundaries of the area which you desire to include, and then locate the house and outbuildings in their proper measured relations to each other and to the boundaries aforesaid. Permanent enclosures, such as corrals, paddocks, etc., should be located in proper size and relations, unless the area to be improved should stop short of them.

Next locate the places chosen for entrance from the highway, to the field or orchard, etc., or to the barn or garage, and flag them with tall stakes supporting a white flag. Mark these also on the plan.

Laying Out With Wheels.—Next go to the point of main entrance to the place, with a long-reach wagon or an automobile, as you choose, and consider the entrance to the house which is of most dignity. Having determined this, drive slowly to it, having such regard for easy grade as you will have previously learned to look out for in your driving through fields —remembering all the time that you expect to get out upon the highway again without turning or even cramping the wheels. This will swing you up to the main entrance and leave your machine right to start out again, and a glance will show you whether you can swing out again between the house and the highway, or whether you have to go around the house to make the turn-around. In either case, go again to the main entrance and you have one main driveway located.

Start again, following the wheel tracks made on the first run from the main road entrance until you reach the alighting place for the house door which you expect most to use, or to the point where you will depart from the first main driveway to reach it. When you have reached that chiefly-used entrance, stop a moment and look ahead for your easiest and most direct approach to the barn and the garage, for this line should reach them both. Drive to these points and consider the way to go from both of

them to the field or orchard entrances, corral gates and all other points which you will be required to most easily and quickly reach from the main highway or from the center of chief activity within the place.

After you have thus practically connected all the main driveways with points which must be reached you can see places where cross-drives from one to the other of the main drives will be convenient, and mark them out also with the wheels. In all your driving do not turn out for the little stakes. You must absolutely disregard them or your drive-lines will be full of little wiggles; forget them entirely and let all your thoughts be upon the point to be reached and the easiest way to reach it, every time you start.

Now transfer your wheel tracks from the earth to the paper by noting the stakes and drawing the road boundaries with the same relation to the cross-lines. After these lines are in place you can see points where slight changes can be made without injury to grade or width and then you will return to the earth and stake out your permanent driveways. It is much easier to stake a driveway that has been run than to run on a driveway that has only been staked.

If the place is small and no interior driveways are to be provided, take a wheelbarrow, put on in front a cross-piece with a peg on each end reaching to the ground, and load with earth or rocks or a fat boy and go through the same process exactly—from the street to the main doorway, from this to other doorways until you make a circuit of the house; then from doorways or from points on the main circuit to the henhouse, the dog kennel, the tennis court, the laundry yard, the vegetable and flower beds or whatever centers of local activity you may plan for. Give the marking pegs the distance apart which is desired for the width of the walk. Of course, after the main drives or walks are determined upon, auxiliary or connecting walks should be decided upon, always with reference to some recognizable purposes in their provision. These may be sometimes cross-cuts to save distance in going in different directions. Wherever possible they should be combined with some other motive, such as to make easier approach to a flower border inviting closer inspection, an invitation to a garden-bench in shade and retirement or a view point for a charming vista—even though it be only a glimpse at your neighbor's laundry yard, which he has made beautiful with the clothes' line posts transformed into pillar roses, crowned with basket capitals of ivy geranium. Not everyone can have a vista of ocean or mountain; sometimes one's neighbor's back door may be worth looking at through your shrubbery.

Straight Lines or Curves.—But having faithfully done this someone may disappointedly say: "My place is very flat and my walks and drives laid out with directness from point to point, are all straight lines with rounded corners. I wanted curving drives and walks." The reply must be that on level surfaces walks and drives must be prevalently on straight lines to be reasonable; on uneven surfaces they are naturally curved to be

reasonable and convenient. If you must have a curved walk on a flat surface you must adopt a formal style with some geometrical elements, and such a design should be made by a professional landscape architect or by an amateur who has carefully studied the subject. We have never yet seen a formal lay-out by a tyro which was not grotesque, while there are thousands of places simply designed by inexperienced persons of good taste which are consistently natural and beautiful.

To make curved walks reasonable on a flat surface one must adopt a set pattern of which they are a part, or he must have some barrier to avoid. If there is a large tree or a natural rock-cropping in the line it is rational to curve around it, but to pile up, in a small opening, a wagon load of rocks for an artificial "rockery," is irrational and generally ugly, while a creation of concrete in such a place is grotesque. One can erect a graven image and cause a walk to curve in worship at its feet, or he can buy a cast-iron deer and amble around to escape his antlers, but the place for all such garden ornaments is in the junk-shop.

A CERTAIN DEGREE OF FORMALITY IS DESIRABLE.

The fact is that a certain element of the formal style is desirable in most designs and is admissible even in work in the natural style when properly introduced or isolated. For instance, in laying out small home sites in the midst of orchard areas, which economy and efficiency require to be planted in straight lines, it is most congruous to take a rectangular space for the buildings; to make drives and walks straight; to make house lines straight and to surround the buildings with beds and borders with parallel edges. It is also consistent to plant shrubs and herbaceous perennials in straight lines, for there will be no great length of them and so far as they go they harmonize with the straight lines of orchard trees. In such a lay-out it is rational to make the driveway at one side of the open space between the house and the highway; to reach the entrance-porch, which is usually on one side of a small house, and to pass beyond for a turning space among the buildings in the rear of the house, unless the garden space is made large enough to make reasonable two entrance gates and driveways, one on each side of the open space. In this case the driveway will cross from side to side in front of the house, as well as extending to the rear of it. In such a case it is desirable to plant no tall growths on the sides of the open space and to make no attempt to insulate this space from the surrounding orchard area. It is better to use the foliage of the fruit trees for an environment and to enjoy the vistas opening between the rows. Fruit land is usually high-priced and a house-grove planted for ornament destroys more land than it covers. Tall trees for shade and ornament should be grown between the outbuildings and enclosures in the rear.

Where, however, there is plenty of land and the enjoyment of a picture isolated from the commercial plantings is desired, the open space should be enlarged and tree-clumps and shrub-masses displayed on either side and irregularly-outlined flower borders provided for on the house-sides of them and the buildings be thus brought into a strictly ornamental environment. In this one should not think of planting shade trees in the house-ends of the fruit tree rows—thus emphasizing the rectangular arrangement which he is seeking to avoid. Nor should the trees selected be of one kind, but of several kinds, which do well in the locality and which the planter admires.

Even when the more remote environment is planned according to the natural system of irregular forms and distances beyond open spaces unmarred by geometry, it is often desirable to immediately surround the house with formal beds (and even terraces, if the ground requires them), providing the lines and plantings be simple and not too inharmonious to blend with the freer features of the environment beyond. Such a connecting link between the elaboration of the house lines and the simplicity of the farther stretches is often very effectively employed.

THE OPEN SPACES.

Reference has been made to open spaces and it should be noted that such should be arranged even in gardens of small area, as has been intimated in the discussion of house-gardens in orchard areas. The walled-gardens of earlier times, and still extant in other lands, are un-American in attitude and spirit. Even fences should be discarded except where intrusion by live stock must be prevented. Hedge rows are being, by common consent, removed to interior separation and concealment lines. The ideal environment of a house, as seen from the highway, is a lawn or some substitute for turf which circumstances may require—as will be discussed in a later chapter. The open space, upon the enjoyment of which the public has a valid claim, should extend from the highway trees to the house front and through rearward vistas also, if that can be arranged. The following paragraph recently written* by Mr. G. H. Hopkins of Los Angeles County, covers many points in the treatment of the open space:

"The best of our present-day gardeners do not cut up the lawn with a lot of flower beds. Where the grounds are not large, the lawn should have only a few low-growing shrubs or palms, while with a larger area occasional trees may be added. The scheme of tree planting should be with the idea of having at least a portion of the buildings in view at all times while passing along the street or highway. Tall trees like the eucalyptus should be planted at the rear of the house. Such trees as the peppers may be planted around the house, but not so close as to hide it from view. Low-growing trees may be grouped around the sides of the grounds and build-

* Pacific Rural Press, Feb. 11, 1911.

ings, with the taller varieties in the background. The flowers can be banked against the house and also be used in front of shrubbery where planted at one side. All plans for planting should be made according to size of plant and tree when full grown. The planting should be done in such a manner that the taller trees will not hide the lower-growing sorts, and the grouping should be so arranged that the house is always in view, so that the view from any point along the highway will be complete."

Suggestive design showing open spaces, trees and shrubs, in relation to buildings—C, chicken yard; B, barn-yard or corral; F, flower beds for cut flowers.

The home-maker can afford to do this much for the enjoyment of the wayfarer and the beauty of the countryside without sacrificing his own privacy. Retirement places with comfortable sittings, lolling benches or hammocks can be easily arranged out of the public eye on the sides of the residence, near to porches or verandas which may themselves be easily screened by vines or shrubs properly placed so that a considerable area of

sun, shade and flowers are used as extensions of the living rooms, as the California climate so amply justifies.

The open spaces are indicated by the areas isolated by the main driveways or walks as they surround them in their courses. Whether they be front, side or rear they may be covered by whatever plant serves the local conditions best for a lawn, or the semblance thereof, and they may be edged or bordered with flowering plants except perhaps the front or main lawn, which should reach to the walk or driveway line with its own substance neatly trimmed to this line and not to border or edging. Flowering plants should not be grown in beds cut into the front lawn nor can they well occupy the whole space thereof. A front yard of flowering plants at their best do not produce the effect of a lawn, and unless given unusual attention and replacement at short intervals, they are never at their best as a whole. Therefore it is better to grow them in borders at the sides or at the foot of the house walls, or, better still, they should be grown for their blooms, for their own sakes or for room ornament, in side or rear beds, and concealed from front-sight by shrubbery or otherwise. The writer's personal choice is to extend the lawn from the street or highway line to the base of the house walls, except such narrow bed as is desirable alone for the growing of the vines which are trained upon the house walls or upon frames attached thereto. The front walks and drives would therefore traverse the lawn area and usually be invisible from the highway, as the eye passes over the verdure toward the building. But there are objections to this arrangement in California, as will be noted in the chapter on lawns.

Windbreaks.—Of course the doctrine of open spaces for the public eye must be considered in connection with adverse conditions which may prevail. If the front yard happens to be in the teeth of the wind it is often necessary to supplement the first line of defence, the highway trees, with other plantings on the windward edge of the garden which may obscure the outer view. In that case the open expression must be sacrificed for the sake of protection. The same is true of the dust from a neglected highway. Trees and shrubs are great dust-arresters and must often be employed therefor. Sometimes it is desirable to select a building site with reference to avoiding these troubles.

Width of Walks and Borders.—The effect of openness or freedom is somewhat dependent upon the width of walks and of borders which may attend them on the outer sides of the garden area, as suggested. The necessity of Indian-filing your visitors through the garden should be avoided. All main walks should be not less than four feet wide, while five feet is better, and short connecting laterals should be at least three feet wide. Plantings should be set back far enough in the borders to ensure this much breadth, free from overhanging. At the same time care should be had not to make the walks too wide in places of small area. No face is at its best with the mouth wide open. Width should be considered in

connection with area and have relation thereto. Driveways which may be expected to serve also as walks should be ten or twelve feet wide in small places, and often as wide as eighteen feet in larger areas. This will enable vehicles to pass each other.

On small places borders should usually not be less than four feet in width, so that two or three plants may still be within reach from the walk and the soil may be worked with hoe and rake without stepping between them, while on large places borders, irregularly two or three times that width, may be desirable. Usually these border plants should not be set in parallel lines but in a way to break lines—unless trench irrigation is planned for, and even then it is not necessary to run straight trenches; turnings in them may cause the water to run more slowly and sink more deeply into the soil.

LAYING OUT FOR LIGHT AND SHADE

In the great interior valleys of California conditions prevail which are striking and characteristic and throw great emphasis upon points in garden design which are quite unique, though widely true of the whole State in varying degrees. Such an element is suggested in the following beautiful paragraphs by the late Mrs. Minna Eshelman Sherman. Writing of her Fresno garden experience she said:

"In laying out a new garden in the country the direction in which the lights and shadows fall should be as much considered as in the lighting of a picture. The fullest beauty of light and shade is obtained if the structural lines of planting are laid east and west. The rising sun, until it reaches the Meridian, throws long shadows and if the garden groups are well planted they show their perfection of colors and shapes through the misty morning light, and as the sun gains strength the new tints of color and greater definitions of form gives added beauty to the garden. The early morning air is nimble with glad quaint fancies when all is at its best in the morning freshness. The same east and west garden is glorified by the golden sunset and the lingering afterglow falls in subdued harmony over the trees and shrubs. It is really two gardens in one.

"Now in the garden planted north and south, in the morning the shadows are black, cold and undefined; at noon the light pours down with a glare and at sunset, instead of golden paths leading heavenward through the flowers, only the tree tops are gilded with the sun. In the moonlight the loss in light and shadow is even more marked, for, as Hawthorne says, 'Moonlight is sculpture.' When the trees, shrubs, flowers and fountains are so lighted that their shadows fall lightly, the massed effects are as though they were cut of stone, all detail is lost in the broad sweeping lines and blocking out of the clear, cold light. The moonflowers and nicotines send out their subtle scents and occasionally a bird stirs sleepily on a tree and speaks softly to its mate. All is still in the great white glory of the

garden, until a mocking-bird begins to sing, at first low and softly, almost under his breath, at last ravished with the glory of the moon, he pours forth a full-voiced song, full of sweetness more tender and more pleading in the rising cadence than the joyous song he sings when the sun shines brightly."

This beautiful manifestation of nature-loving arose from Mrs. Sherman's life in a valley where planting of tall poplars and eucalyptus, as windbreaks along highways and property lines, has widely prevailed. As the strongest winds in California are southerly and northerly, except on the immediate coast, the pictures Mrs. Sherman paints are fortunately attained by the same east and west planting which affords greatest protection. Therefore her suggestion is not only beautifully expressed, but is of direct practical advantage.

SUN AND WIND IN THE HOT VALLEYS.

In the interior foothill and valley situations shade from the midday sun is grateful to many flowering plants. Such a sunshade on the south line of the garden as Mrs. Sherman has in mind is that along one of the most beautiful avenues on the Eisen vineyard, Fresno. It is of tall Lombardy poplars, alternated with red oleanders, while overhead are trained grapevines. The oleanders are full of bloom in the summer and the aroma makes the air heavy with an oriental sweetness. In the autumn there comes the scent of grapes and the purple, red and white clusters strung overhead on the brown stems, with the tinted leaves, are tone pictures. This avenue, made of the simplest and cheapest growths of the country, is one of the most successful for a valley situation and is practicable wherever summer heat is adequate to the full blooming of the oleander and mountain freezing does not injure it in the open-air freedom which it widely enjoys in California. Partial shade is a real issue in interior heat and should generally be planned and planted for. It will give much fuller satisfaction with sweet peas, pansies, asters, gladioli and other flowers which bloom in midsummer. If shade can be supplied during a few hours of the afternoon, either by planting in the shade of other plants or trees or by artificial means, in the rear garden, it is desirable.

Hot north winds are also very injurious to plants, especially in spring, when tender foliage and buds are out. The entire crop of spring roses may be destroyed by one severe wind. When possible, a protection should be supplied. An evergreen hedge or trees, sufficient to break the force of the wind, will greatly insure the safety of the flower garden. Therefore, as we have been pleading for openness in the front areas, we reverse the argument for the side and rear areas and bespeak for them a certain degree of seclusion and protection as the local climatic conditions may justify, and these blessings also the household, which can so well make the California-garden a living-place, will appreciate and enjoy.

CHAPTER VI.

ELEMENTS OF PROPAGATION.

From the point of view of the amateur, propagation may be defined as the art of making young plants from old ones. One might say "new plants" from old ones were it not that newness in a horticultural sense should imply some attainment of difference or variation; something not previously existing with the same character or qualities. This creative act belongs in the categories of the new science of "genetics" with which we are not concerned at this time. To propagate, then, is simply to make a younger plant as nearly like an older one as nature in her thirst for novelties will allow.

There are two parts of mature plants which can be transformed or trained into younger plants. One is a seed; the other is a bud. In both of these and not elsewhere nature has placed the possibility of securing a young plant from an older one, and it is the function of propagation to devise methods, arrange conditions, etc., in such a way that nature shall be stimulated to realize this possibility most abundantly.

Growth from a bud reproduces, almost without exception, the plant from which the bud is taken and this is often a very important consideration. Growth from a seed almost always includes probability of variation; occasionally for the better, but usually for the worse, if the older plants are themselves variations from fixed or wild types and are desirable because of their differences therefrom. Fortunately, however, there is a way to limit this tendency to variation and to make growth from the seed widely dependable, viz.: to select seed from plants of the type desired.

The growth of plants from seed depends upon the skill of the propagator in securing strong germination and in protecting the seedling from the dangers which beset its infancy. The growth of plants from buds involves other requisites in manipulation. Conditions for growth are, however, roughly alike and they are heat and moisture—each in the right degree or amount for the particular plant in hand, though, fortunately, most plants have hardihood to withstand various conditions and do not usually exact the very best—though the most skilled propagator is the one who places the least burdens upon a plant's endurance of hardship. There is certainly a personal equation in propagation, but there is no mystery about it. The common remark of a man, "Everything my wife plants grows, but nothing grows for me," is not an indication of a magic touch. It simply means that the lady, consciously or otherwise, ministers to the needs of the plant. Perhaps it also means that women have a quicker apprehension, and more patient observance of details than men. What these details are,

in growth from a seed and from a bud, will be suggested in following chapters.

The office of the seed in the multiplication of plants is generally understood, relied upon and does not need definition. Less attention is given to the growth of a young plant from a bud of an old one and it is therefore excusable to place a little more emphasis upon it in this connection. Well-formed buds may be cleanly cut away from the branch of a woody plant, with a morsel of the connecting tissue, and placed against the inner bark (cambium) of another plant, and when it is protected from too great loss or gain of moisture (sap) by proper tying down of the outer bark, it will grow and make a new plant, if the root-force is restricted to its service. This is what is commonly indicated by the term "budding." But "grafting," or taking more of the tissue of the old plant in connection with the bud or buds which are intended to grow, is also "budding." And propagating by "cuttings," by which desirable buds, or tissue of root, stem or leaf capable of forming buds, are taken from an old plant and treated in a way to develop from a growth of cellular tissue (callus) roots, or roots direct without callusing, which shall cause bud-growth, that is also, in a sense, "budding"; and so is "layering" or turning down a branch so that earth-contact shall cause it to develop roots beneath a bud which pushes upward to the light. The making of a new plant by "dividing the roots" of an old one; the taking of a bulblet from a bulb, or the planting of a "bulb-scale," or any other recourse by which a younger plant is derived directly from the tissue of an older one—all are really propagation by "budding," because it is the bud which holds the potentiality of the plant from which it is separated, and will manifest it if its requirements of heat, moisture, sap-pressure and light are duly met by the propagator.

It is a teaching of experience, however, that different plants have different attitudes toward the effort to reproduce them from buds, just as different plants produce seeds which are easy to grow or grow with exceeding great difficulty. And thus it comes to pass that although theoretical multiplication of plants, either from seeds or buds, is very simple, the practical doing of it has taxed the insight and ingenuity of propagators for centuries, and there is still much to learn about it. Therefore the beginner must expect to learn much from his own failures and successes, even though the book-maker does his best in bringing to his assistance the experience and observation of others.

CHAPTER VII.

GROWTH OF PLANTS FROM SEEDS.

Conditions essential to the germination of seeds are heat and moisture in degrees and amounts meeting the natural requirements of the kind of seed, as may be noted in certain cases later. It is, however, true that medium conditions suit seeds of most plants, as may be inferred from the common use of descriptive words; that is, the soil in which they are expected to grow should be warm, and neither hot nor cold; it should be moist and neither dry nor wet. The presence of air is also necessary, but the occurrence of a vacuum is practically impossible in any gardening outfit. Germinating seeds do not require "fresh air" in the way that growing plants or the higher animals do, and if a propagator should secure for his seeds such a supply as he might desire for himself, they would probably fail of germination, through loss of heat and moisture. Growing seeds do not need "sleeping porches"; they do better in "incubators." Let the beginner, therefore, seek to secure proper heat and moisture and these are insured chiefly through four agencies—the right kind of soil; regulation of sun heat by covering, for conservation or exclusion; production of heat by fire or fermentation; regulation of moisture by sprinkling and drainage. Although the three last named are largely secured through the action of suitable soil as a conveyer of heat and moisture, the air is also a conveyor thereof and must not be allowed to rob the soil with which it comes into contact. For this reason air may be freely admitted or must be largely excluded according to the degree of temperature or aridity which it carries at the time.

For this reason seeds usually need to be covered into the soil and the soil pressed firmly around them to secure uniformity of heat and moisture by immediate contact which prevents too free air-movement. Contact also enables the rootlets of the germinating seed to lay hold on the soil particles and thus begin to use soil nutriment. It is impossible to give an exact rule for the depth of soil-covering for soils are various and act differently in moisture conveyance and air-movement. A certain very old rule may, however, be suggestive, viz.: that the depth of covering should be four times the diameter of the seed. This would cover a sweet pea about an inch and allow a poppy seed to be merely pressed into the surface—and this, under good growing conditions, would be about right in both cases. As most flowers produce small seeds the common advice to "cover lightly" is good, and it is manifestly nature's example, for most wild seeds are surface-sown. But there is another hint which the sower of seeds in open ground should take from nature. The soil in wild places usually has a crumby surface owing to its disturbance by ground insects and the crumbs

are more or less mixed with decaying fibers of fallen leaves, etc. This crumby condition admits a small seed to enter and the fibrous material holds the crumbs from being blown away by the winds and at the same time, by its decay, forms humus which not only feeds the young rootlets but also holds moisture nearby for their use. Good garden soil should have these characters not only at the surface but as deeply as they can be had, either naturally or artificially, as is discussed on page 26.

The depth of covering for seeds depends upon the character of the soil, and, in California at least, upon the expectation of additional moisture. As the soil approaches "sandy" the covering may be deeper and as it is more "clayey," the covering may be shallower. In both cases, if it is early in the growing season and therefore with greater expectation of rain, the covering should be shallower than late in the season, when surface-drying is anticipated. Obviously if uniformly moist condition is preserved by irrigation, this difference becomes of less importance, though it does not wholly disappear because even with irrigation the air is drier as the rains cease or become lighter and less frequent.

Covering the soil surface.—The germination of seeds in the open ground is promoted by covering the soil after sowing with a light litter of dead leaves, chaff, lawn clippings, broken straw or other comminuted vegetable substance, because this covering holds surface moisture, reduces sun-baking or rain-puddling which form a crust, and probably protects the shooting germ also from heat and cold to some extent. This covering should always be light and thin to admit air freely and to prevent fermentation of the substance itself, which might injure the seedling. Crusting of the surface is destructive to seedlings in several ways and a crust is more easily prevented than cured, although disintegrating the crust, if it is allowed to form, is essential. This is most safely done with careful downward thrusts of the rake; straight raking is only admissible with deep-covered seeds and then before shoots are too near the surface. While vertical breaking can be done even after the plants have appeared above the surface.

The beginner should be warned against using too much coarse stuff in connection with seed sowing. Too much manure may kill seedlings directly; too much manure or other coarse stuff may kill seedlings by the heat of fermentation or by drying out the soil too much.

The following is an explicit recipe for open ground seedlings which may help those who demand formulas:

"If you do not care to sow in boxes you can sow in the open ground. Select some spot that is sheltered and has an eastern exposure, spade up and rake smooth, sow the seed broadcast and rake it in. Then firm the ground on top with a board, water, then top dress with clippings from the lawn, straw from the stable, or, best of all, make a screen out of cheese-

cloth, drive four stakes down to within six inches of the ground, and shade with the screen. These different methods are to keep the soil from baking on top, for as the seed is sown very shallow it germinates and the ground is baked, which kills the small plants. If you use a screen it will act as a protection from late frosts."

SPECIAL ARRANGEMENTS FOR GROWING SEEDLINGS.

For the protection of seed from unfavorable conditions during germination and the seedlings from intrusions of various kinds during their early life, arrangements for covering are approved by long experience and they are of such a simple character that any amateur can easily provide them. They all relate to growth under cover and involve the same principles which have been suggested in the protection of seeds and seedlings in the open ground, and are designed to attain similar results. They also involve the art of transplanting as in many ways superior to sowing seeds in place, and though this is often a bugbear to amateurs, it should be resolutely mastered for there is great satisfaction in it.

Growing Plants For Transplanting.—One who does not understand and practice the growth of plant seedlings on the side, for transplanting to permanent place several weeks later, makes his gardening harder and less likely to succeed. It seems, of course, easier to scatter the seed where the plant is desired to grow, and that is the act which many are apt to think comprises gardening art. Truly, however, this is not, on the whole, good gardening at all, though it may be the best for some plants and for some conditions.

The plant as it comes from the seed is least able to withstand adversity. Unfavorable temperatures, irregular moisture, thirst or suffocation by crowding of weeds, loss of root-hairs by burning crusts or by mud causing decay, injury by marauding insects—all these and others are perils of seedlings in the open ground. From the point of view of the grower other considerations intrude; delay in waiting for temperature and moisture conditions which favor the start from the seed, causing the loss of that most desirable thing, the earliest possible growth which is consistent with safety; increased tillage of a larger area, which requires a maximum of labor and cost when seedlings are to be guarded from injury by tools; loss of opportunity to clean the land and to secure deep and complete working of the soil which a plant needs to make its quickest and freest growth, as soon as it has passed the perils of childhood as a seedling.

These general reflections are indulged in to emphasize the fact that the amateur flower-grower should be a persistent transplanter and to meet a common misconception that a plant is always better if the seed is placed where the plant is to grow. The facts are otherwise. Transplanting is a great help in saving time and in keeping the garden continuously beautiful.

Seed Boxes.—Although much can be done with open seed beds of small area under the protection of a board fence on the side of the building, and with the half-shade of a lath-frame or a brush cover, as such may be needed, against too fierce sunshine, it is better to take a little more trouble and secure better arrangements. Seeds of trees, shrubs and herbaceous plants of all kinds can be far more conveniently grown in seed-boxes or in "flats," which may be either shallow boxes or "saucers" of the same burnt clay as common flower pots. The latter are very shallow and usually have only such drainage as the porous material may furnish, though, of course, shallow flower pots, such as are often used for ferns, have drainage holes and also belong to the class of "flats." On the whole, however, the use of seed boxes is better. These are made of half-inch redwood, about three inches deep and preferably rather small in amateur work, so that weight of box and soil shall not be too great for easy handling—12x15 or 15x18 inches are convenient sizes. Several half-inch holes should be bored in the bottom boarding, or if the bottoms are made of two or three pieces, cracks wide enough to escape closing by the swelling of the wood will do for drainage. Seed boxes can also be cheaply made by cutting down merchandise boxes to a proper depth and making holes for drainage, but the amateur who likes to use tools and to see things neat and trim, will usually take more pleasure in an outfit of seed boxes of uniform size and aspect.

Sowing In Seed Boxes.—Seed boxes should be filled with finely granular soil free from hard lumps and containing finely fibrous material. A mixture of one-half clean sand, one-quarter garden loam and one-quarter fibrous material, such as finely-broken old cow manure, or leaf mold, or decayed grass roots or rotted lawn trimmings, or, best of all, the peat used by florists. Such a mixture will take water readily, part with it without baking and give the seedling all the soil conditions favorable for its early growth. Having thoroughly mixed the ingredients, fill the box even full, strike off the surface with a straight-edge and press down the soil evenly with a block so that it is quite firm. This will leave the soil surface half an inch or more below the edges of the sides. Sprinkle the seed over the firmed surface and press lightly with a clean block. Then sift on a covering of the mixed soil, well rubbed up—more or less according to the size of the seed—and water with a fine spray. A light covering of dry spagnum moss, well rubbed up, will hold the soil from shifting under the spray. In the case of very minute seeds, fern spores, etc., the seed should be pressed down and covered with the spagnum without the soil covering.

A California propagator of wide experience gives the following very explicit directions for handling minute seeds:

"Some seeds are so small that their form can scarcely be distinguished with the naked eye. Skill is therefore required to raise plants from them.

The soil should be of such character that it will not bake. Woods earth, composed largely of leaf-mold and sand, does very well. It should be partially dried and carefully sifted through a fine sieve. A flower saucer is the best vessel in which to sow such seeds. Fill it with the sifted soil till even with the margin, then jar the saucer to settle the soil, and with a smooth block press it until the surface is as smooth and level as a planed board. Now press rows, with the edge of the block, just deep enough to be distinguishable, and in these rows scatter the little seeds evenly but thinly. To do this take a sheet of smooth note paper, turn up the edges, and crease one end slightly to make a run for the seeds, then shake the paper along the row so that the seeds will be distributed as desired. After sowing, place the saucer in another saucer of larger size, and pour warm water into the outer saucer. The pores will soon admit the water to the soil. When moist enough raise the inner saucer until it stands out of the water, or empty the outer saucer. Water by this means, keeping the soil merely moist—not wet. Cover with thick dark paper till the seeds start, then remove the paper and cover with glass, raised a half-inch or more above the edge of the saucer, so that air may be admitted around the margin of the saucer. Never cover such small seeds. Be very careful not to keep the soil too moist, and equally careful not to let it dry out. This caution with reference to watering should be observed until the plants are quite large. Darkness promotes germination, but is injurious to plants. Be careful, therefore, to uncover the seed vessel, and admit light as soon as the seeds germinate. As the seeds are always in full view when the cover is off, you can readily tell when germination is effected. Admit light gradually to the young plantlets, and never allow the direct rays of the sun upon them. As soon as large enough prick them out into larger vessels, where they will not be crowded. A small-bladed penknife can be used for that purpose."

Distributing Fine Seeds.—Another way to sow evenly very fine seeds, such as calceolarias, tuberous-rooted begonias, fern-spores or in fact any very fine seed, take a piece of white pasteboard the size of the box, pot or pan in which you are going to sow your seeds, rub the seeds over the cardboard until they are evenly distributed, then invert on the soil, and by tapping gently, the seeds will fall as evenly as they were rubbed on the cardboard.

AIDS TO GERMINATION.

Various chemical substances have been advocated as aids to the germination of seeds, but none, to our knowledge, have demonstrated any efficiency and none are used by most successful propagators who rely upon proper application of moisture and heat, through the medium of a soil possessing the characteristics noted above.

Seeds with considerable fibrous covering or appendages are assisted by soaking before planting so that this absorbent material may not take too much moisture from the adjacent soil to accomplish its softening. In such cases soaking in lukewarm water for several hours is desirable. Very hard seeds, like those of the accacia and locust trees and some herbaceous legumes and other plants, are greatly hastened by scalding—actually boiling water does not injure the germ and admits needed moisture to entrance by disintegrating the horny covering.

Damping-off.—There is apt to be great loss of promising seedlings both in the open ground and in seed under cover, by action of a fungus causing what is commonly called "damping-off." This fungus usually attacks the stem near the ground and destroys the plants, though the parts above and below seem normal. The growth of this fungus is favored by excess of moisture, either in the air or on the soil surface. Sometimes seedlings fail because the ground is kept too wet, but in that case the root fails. If the surface is too wet and the atmosphere generally too humid, there comes this "damping-off." It may be produced by rather a small amount of water, providing the soil is heavy and the water is not rapidly absorbed and distributed. On the other hand, a lighter soil taking water more easily may grow plants without damping-off, even though a great deal more water has been used than on the heavier soil. Too much shade which prevents the sun from drying the surface soil is also likely to produce damping-off, therefore one has to provide for just the right amount of shade and the right amount of ventilation through circulation of the air, etc. The use of sand on the surface of a heavier soil may save plants from damping-off, because the sand passes the water quickly and dries, while a heavier surface soil would remain soggy. Lime may be of advantage, if not used in too great quantities, because it disintegrates the surface of the soil and helps to produce a dryness which is desirable. Success lies in keeping the surface dry enough and yet providing the seedlings with moisture for a free and satisfactory growth. Obviously it is safer to use more water at longer intervals than to be constantly sprinkling and thus keeping the surface wet. This is a matter which must be determined by experience and good judgment and cannot be completely covered by any formula or prescription.

The fungus can be killed in the soil by soaking it with one ounce of formalin to twelve gallons of water—using about three quarts to each square foot by sprinkling—but the amateur will succeed well enough by regulating the surface moisture and air as indicated.

CHAPTER VIII.

GROWTH OF PLANTS FROM BUDS.

The multiplication of plants by the use of buds has been outlined in Chapter VI. The methods employed arrange themselves in several groups, which are given distinctive names:

1. Cuttings: In which one or more buds are treated in a way to induce the growth of roots and the starting of shoots directly from the severed portion of the old plant.

2. Layers: In which a branch is made to pass through earth, contact with which induces root-formation and shoot-growing, after which the branch is severed from the old plant and cut into as many plants as there are shoots from rooted parts.

3. Buds: In which a severed bud with a minimum of bark is placed flat upon the inner bark of another plant of a kind demonstrated by experience to be disposed to combine the tissues of the bud with its own and cause it to grow by its sap pressure and sustenance.

4. Grafts: In which the branch with one or more buds (called a "scion") is cut wedge-shaped and placed in such a way that the inner bark of the scion shall make contact with the inner bark of the plant upon which it is desired to grow, and which is called a "stock." Uusually grafting is done by splitting or cutting into the central wood of the stock, so that the scion stands more or less vertical and makes its contact by the meeting or crossing of the inner barks rather than by being flatly pressed, one upon the other, as is the case in budding.

ESSENTIAL CONDITIONS FOR GROWTH FROM A BUD.

In all these operations there are several conditions which must be present, or requirements which must be met.

There must be a disposition on the part of the particular cutting, or layer, to make roots for itself or on the part of the bud or scion to accept impetus and nourishment from the roots of the foster plant upon which it is properly placed. In the former case the horticulturist says of the plant, "It roots readily," and in the latter case he says, "It has affinity." But this behavior, or the opposite, has been found by experience to be dependent upon certain conditions in the soil or in the foster plant which may determine degrees of "rooting readily" and "affinity" or may demonstrate these methods of multiplication to be impracticable. This is a matter which cannot be determined by inference that because one plant acts in a certain way another will also do so; the fact must be learned by actual test or from the records of the experience of others, and such records of

propagation have been handed down from most ancient times and constitute an important branch of horticultural wisdom. It is encouraging, however, to the beginner to be assured that most plants do readily accept multiplication by self-rooting or foster-rooting of severed parts, whenever the gardener's art meets its humor, and therefore it becomes necessary to know general conditions which are essential, also to study the way of the plant one wishes to handle successfully.

Next to knowing methods which meet the "disposition" or "affinity" of the plant, the essential conditions to be provided are moisture and heat—followed by light, as the development of green tissues becomes desirable. These are the same which secure the growth of a plant from a seed; in fact, they are causative of all plant growth. The growth of a young plant from the seed or from a severed part differs, however, from the general vegetative action of an established plant from the very fact that it is not yet established and furnished with tissues to sustain cell-action during temporary adversity; it can only hold life in its cells amid a favoring environment and during a certain period of time—according to its own degree of resistance and which is largely determined by its own disposition and substance.

The presence of adequate and yet not excessive moisture is a prime requisite. The arch-danger of a severed part of a plant is "drying-out"; another danger is "drowning out"—the latter much the less, because certain growths are favored by excessive moisture while others are ruined by it. And this is true whether it be a cutting in the soil or a bud or scion in place, for either of the latter may be dried up by a scant sap-flow or "drowned" by too great a flow. All these facts show that for all severed parts which are expected to grow inadequate moisture is destructive, and excessive moisture may be.

The second requisite, heat, is important, but variation in its occurrence is less injurious. Still, the degree of heat favorable for different forms of growth should be carefully heeded and arranged for. Heat in connection with proper moisture causes cell-activity or growth, and the absence of a proper degree of heat reduces the resistance of the tissues to decay germs, which are always ready to invade and destroy them.

Roughly, the relation of heat and moisture in the growth of a young plant from a severed part of an older one may be stated in this way:

The harder, or more dormant, the tissues of the cutting, bud or scion, the less may be the moisture required to resist drying out, and the lower the heat required to induce growth—which may be deferred for some time without injury.

The softer, or more active, these tissues, the greater the moisture needed to prevent drying out, and the higher the heat required to induce quick start of growth processes—which cannot be long deferred without inviting decay of the tissues.

PLATE 4: "COMFORTABLE SITTINGS, LOLLING BENCHES OR HAMMOCKS CAN BE EASILY ARRANGED OUT OF THE PUBLIC EYE"—PAGE 51.

The contrasting conditions and agencies may be expressed in this way:

DORMANT TISSUE	ACTIVE TISSUE
Less moisture	More moisture
Less heat	Higher heat
Slower start in growth	Rapid start in growth

Although this contrast is warranted to emphasize general relations, it should also be stated that greater moisture and higher heat are used to hasten activity of dormant tissue also, when that is necessary or desirable.

How these agencies are brought to bear in propagation will be noted in the following discussion of materials and methods:

GROWTH OF PLANTS FROM CUTTINGS.

Cuttings are severed portions of any part of a plant—leaf, twig, branch, stem or root—which experience has shown to be desirable. These words are used in designating their source and they are also even more specifically localized by the use of such words as "tip," "base," "terminal," "lateral," etc. Such words may be encountered in discussions of particular plants in subsequent chapters. The unqualified word "cutting" is intended to designate an ærial part of the plant, and to have a more or less woody character. From this point of view cuttings may be divided into two classes, viz.:

Hard Wood Cuttings—Which are usually mature, dormant, and taken from deciduous plants, or from some evergreens during their brief periods of lessened activity.

Soft Wood Cuttings—Which are usually immature, more or less inactive growth, herbaceous, and are taken from either deciduous or evergreen plants during their active growth.

Obviously both kinds of cuttings can be taken from many plants at different times of the year. Obviously, also, strictly herbaceous plants never afford any hard-wood cuttings, but many of them grow so readily from soft-wood or herbaceous cuttings that nothing more than open-ground treatment is required for them. This is a fact which, much to their disadvantage, many beginners do not know.

Length of Cuttings.—As a single bud possesses the potentiality of a plant, a cutting or a severed-part taken for making a younger plant need only consist of one bud and its adjacent tissue from which roots may strike. But in operating with such a small fragment there is such imminent danger of drying out that single-bud cuttings are seldom used, except when the variety is exceedingly rare and the reason for rapid multiplication imperative. In such a case it is possible to make plants from single dormant "eyes" or buds by increasing heat and securing humid atmosphere as well as adequately moist soil, and these must, in nearly all cases probably, be artificially produced.

Root cuttings are more often single buds, as in the case of fragments of running roots or the subdivision of root-crowns, but this is rather different from the single bud we are considering, for it usually has certain root-parts already developed.

From the difficulties encountered in securing rooting and top growth from a one-bud cutting it is evident that a piece having several buds is to be preferred—not because one needs top-growth from more than one bud nor because one has to cover buds into the ground to get roots—for the fact is that in woody cuttings roots do not come from buds nor necessarily from near the buds, but grow first, at least, from the soft cellular substance which forms at the cut end of the cutting, and which is called the callus. In herbaceous cuttings this is not necessarily true. The formation of this callus depends upon adequate heat (differing with different plants) and upon the requisite amount of moisture and the length of the cutting, evidently serves two purposes; first, the protection of its own substance from drying out by conserving the moisture which it brings from the plant from which it has been severed; second, penetration into the soil to a depth where there will be permanent moisture below the drying of the surface. But this penetration has its limits because callusing needs heat, and with low heat proceeds slowly, and therefore must not reach down into cold earth or standing water or mud, which, during the California rainy season, when hard-wood cuttings are generally rooted in the open ground, are apt to be encountered. Standing water also excludes air and invites decay in some plant tissues.

The length of the cutting, therefore, depends upon several conditions—the nature of the plant; the character of the soil as related to heat, moisture and circulation of air; the anticipated addition of water by rainfall or irrigation; the amount of soil heating to be expected from the sun at that time of the year, etc. If all of these are taken into consideration cuttings of different plants may range in length from several inches to several feet. One may take, for example, in the month of December, a cutting of a rose bush, the thickness and length of a new lead pencil, and plant it with three-fourths of its length in the ground and at the same time take a branch of a locust tree six feet long and thick as his arm, and plant it one-fourth of its length in the ground for a fence post. In the following May he may pick roses from his rose bush and tie them into a bouquet with foliage from his fence post. This specific statement may convey to distant readers a concrete demonstration of the character of the so-called winter months in California.

Manifestly one cannot be too arbitrary in prescribing length for cuttings, but if the reader insists upon having a set of rules, let it be this: (1) Make cuttings for rooting in open ground six to eight inches in length and from one-quarter to one-half inch in thickness of wood, as you may find it. (2) Make cuttings for growth under glass about one-half these dimensions.

(3) Plant both kinds of cuttings with about one-fourth of their lengths above the soil surface.

Hard Wood Cuttings.—The beginner should not put too much emphasis on the word "hard," for cuttings are more or less hard, according to nature of the plant from which they are taken and at the time they are taken. When the growth of a woody plant passes from the succulent stage to the development of tough fiber it begins to be hard and such fiber progressively develops until the new growth matures and assumes a distinctly woody character. Some plants root readily from cuttings all

Hard wood cuttings and way of planting.

through this progressive period. Others show readier rooting during its earlier than its later stages. For example, many shrubs can be best started from cuttings of the half-ripened wood started in wet sand during the summer months. The cuttings should be taken just as the young growth is changing from a succulent to a woody state. Weigelas, spireas, philadelphus and many other shrubs propagate very readily in this manner. Other growths start more readily a little later in the maturing, and others are very easy when fully dormant. Some, like the rose, root readily all through these changing stages—providing conditions in air and soil are kept right to prevent drying out. From this it may be rightly inferred that cuttings are generally to be taken from the current season's growth or what is called "new wood," but this is not always essential, for some plants root readily from older growth. Hard wood cuttings are usually made by cutting just below a bud at the lower end because the harder tissue is thicker at that point, and less pith is disclosed. But this is not always desirable; in fact, a callus often forms more quickly if the cut is made between the nodes or "joints," because the tissues are a little softer and the cells more active. This contrast is related to what has been said previously about heat and moisture as involved in the growth of cuttings of different densities or

textures. There is, however, at least one plant that prefers to root when cut at a joint—the clematis.

Planting Cuttings.—As with seeds, so with cuttings there must be close contact between the soil particles and the tissues which are to send forth radicles to lay hold upon them. Therefore pressing the soil about the base of the cutting is indispensable, not so much perhaps for the grasping of the rootlets as to exclude too much drying air and to promote movement of moisture between the soil particles toward the tissues which are making growth. The surface soil above, however, should not be compacted but kept mellow to reduce evaporation. But do not make the mistake of planting cuttings too tenderly; pack the earth firmly around the lower end.

Soil For Cuttings.—Clean, sharp, rather coarse, screened sand, such as plasterers use for the first coat, is ideally best for the growth of all cuttings, although hard wood cuttings will start freely in ordinary garden soil, if they are disposed to "root readily," and that has to be learned from experience, and tests with all kinds of plants are commended to amateurs who are trying to get wise. Cuttings which are not ready-rooters should be tried in sand with due regard to preserving moisture, of which sand is not retentive. Where the garden soil is not mellow there is a sand enclosure with which a fussy amateur declares he has grown everything he has ever tried from cuttings. Make a hole about an inch in diameter and four or five inches deep with a dibber or sharp-pointed stick. Fill this partly with sand, then put the cutting in; fill the space around it with more sand, packing it firmly with another stick and a mallet. Of course, it would not do to pack ordinary soil in this way; besides pouring in water will usually settle the sand sufficiently.

Soft Wood Cuttings.—Soft wood cuttings are also variable in condition, from a fresh growing tip to a much harder substance in which, however, woody fiber is either not present or has not hardened. The token of fitness for a soft wood cutting of many plants is that the piece will snap, or part with a clean break, when bent back upon itself, and not crush or splinter or bend without breaking. This is particularly true of semi-herbaceous plants, such as chrysanthemums, heliotropes, geraniums, fuchsias, verbenas, coleus, begonias, etc., but is not true of all soft wood cuttings; for cuttings of roses, carnations, etc., should always be prepared with a sharp knife. Here again we fail to find a fixed rule and have to be guided by experience with the plants individually. Cuttings roughly broken or torn from plants will root satisfactorily under proper conditions, but a clean break or cut favors the growth because there is no crushed tissue; besides, cuttings neatly taken do not disfigure the parent plant with wounds slow and hard to heal.

Soft wood cuttings, and hard wood cuttings also, if not planted in open ground, are most easily handled in the boxes which have already been

commended for growing seedlings, filling them with clean, sharp sand and giving them bottom heat by a hot bed or protection in a cold frame, as will be described in the next chapter. Soft-wood cuttings should be short, about three inches in length, planted not less than two-thirds their length in the sand. There should always be left at least the half of a leaf, and in some cases one or two leaves will not be too many. Shading from the bright sun will be necessary to prevent wilting, and the surrounding atmos-

Soft Wood or Herbaceous Cutting.

phere must be sufficiently moist to prevent evaporation from the surfaces of the leaves. The cuttings should be set in rows about an inch apart and thoroughly soaked with water when set. Afterward water must be used with extreme care, because of liability to rot the cuttings. This is prevented by cautious watering and by increasing the heat which hastens the growth processes. Cuttings may be watered well daily for six or seven days, until they have well healed over, then water should be withheld until the sand becomes dry on top, and then resumed and continued at longer intervals.

Soft wood cuttings will begin to root in from eight to ten days; hard wood cuttings in double that time. Soft wood cuttings can be rooted at almost any time of the year, when the proper wood is to be found and the necessary temperature can be secured.

Some amateurs have found the following arrangement for cuttings on a small scale satisfactory: Take two flower pots—one two inches greater in diameter than the other. Put sand in the bottom of the larger pot until

the smaller one, placed inside, has its top edge level with that of the larger; then fill all around the smaller pot with sand. Put a cork in the hole of the smaller pot and fill it with water. After all the sand has been well moistened, insert the small cuttings in the sand-circle between the two pots. Keep the smaller pot full of water and be sure the drainage hole of the larger pot is kept open. This will keep the sand evenly and continuously moist. The outfit can be kept in a sunny window or other warm place until the cuttings have rooted.

Transplanting Cuttings.—When the cuttings, either of soft or hard wood, have made some leaf-growth in the sand-pot, or in the boxes previously mentioned, they should be carefully taken from the sand and placed in small flower pots, or at greater distances apart in other seed-boxes, using such prepared soil as has been described for the growth of seedlings. In a few weeks they will be ready to transplant to open ground if that is their destiny. Farther discussion of this operation will be found in a later chapter on planting.

GROWTH OF PLANTS FROM LAYERS.

A layer may be defined as an unsevered cutting because, aside from the fact of immediate severing, the method of multiplying plants in this way is so similar to the ways with cuttings. It is relatively a much more trouble-

How to make a Layer.

some process and is therefore resorted to by experienced growers only with those plants which are found to be difficult to root from cuttings. Beginners resort to it more widely because they distrust their ability to cut loose from the parent stem. Layering is usually done by taking a long shoot and bending it to the ground. A slanting cut is made about half through the shoot from the top, and it is then bent a little to one side and pinned down in a slight furrow in the ground. A piece of wire can be bent

like a hairpin to fasten it in place, and then the place is covered lightly. If kept moist the covered part will strike root and the outer end will be found after a time to be rooted and can be transplanted. By covering a long branch or cane several plants will be secured at one operation, as there may be shoots and roots at each joint and they can be cut apart and separately planted. This is a very successful way to get new plants of "asparagus fern"—asparagus plumosus.

The same principle can be employed in rooting upright stems without laying them down, by arranging a split pot or other receptacle to hold soil around such a stem. This is a less certain method because of the difficulty of keeping the soil continually moist enough to cause the rooting. This requires constant attention.

BUDDING AND GRAFTING.

There is a multitude of ways of bringing a part of one plant in contact with another so that the "inner barks" or "growing layers" (cambium) of both shall grow together. This art has been known from prehistoric times, probably, for the earliest literatures make references to it, and all races of men which have dealt intelligently with plants have devised ingenious methods of employing the natural disposition of certain plants to unite their tissues and combine their energies while each largely maintains its own characteristics of growth and production. It is the latter endowment by nature which makes the art of uniting plants chiefly valuable; for if plants were disposed to merge their characters as they do their tissues, grafting would have been abandoned by the ancients as an art of confusion rather than accepted by them as a foundation of systematic production. From this point of view nature renders great service to man both by what it refuses and by that which it consents to do for him.

Both budding and grafting are accomplished with hard, dormant tissues awaiting the growth-impulse; also with soft, active and herbaceous tissues —but the methods and the environment are different. There is in fact a certain analogy between the successful grafting of hard and soft tissues and the growth from hard and soft cuttings as indicated on page 64. The difference in affinities, and in successful methods of contact, are such that: (1) Certain plants unite by all methods of budding or grafting; (2) other plants unite by some methods and not by others; (3) other plants will unite by no known methods. As no one person can possess the full record of human experience on this point, the trial of different plants and methods is always open to the amateur, and, though his results will be mainly rediscoveries, they will be none the less original and satisfying.

Essentials to Budding and Grafting.—Next to natural consent or affinity, which has been sufficiently emphasized, indispensable conditions are the following:

1. Contact of cambiums; which may be considerable in area or but little, according to whether the plant "buds or grafts easily," or otherwise, as ascertained by experience. 2. Protection from entrance of air to cause drying of the contact-areas and of the added part; such protection being complete or partial according to disposition of the plant to produce connective tissue rapidly or slowly; also according to the degree of activity or dormancy of the sap flow at the time and the length of time before increased activity thereof is to be expected.

The chief difference between buds and grafts is that dormant buds are expected to "unite" very quickly (although shoot-growth may be postponed for months) while grafts unite more slowly and must maintain life longer before moisture can enter their tissues from the "stock" into which they are inserted. For these reasons the bud is used when the stock is in active sap-flow; the graft may be able to wait a considerable period and is therefore employed when both scion and stock are dormant, though preferably inserted toward the end of the dormant period. In California, however, few plants are as dormant (or as low in sap flow) as in wintry climates. Even after leaves have fallen, the tissues are less dry; therefore grafting is possible from the fall of the leaf until the bud-swelling indicates the approach of a new season's growth. Besides the scion itself loses moisture more slowly in the damp air of the "rainy season" than in air "frozen dry" by low temperatures.

The method of protection from too free or continued air-access is determined by the facts just cited. "Buds" are usually held in sufficient contact and sufficiently protected by wrapping firmly, but not too tightly, with soft twine, a narrow strip of cloth or of raffia—to be loosened in a few days if the bud retains a natural color or plumpness which shows that it has "taken" or has made its union properly. "Grafts," however, are to be firmly held by a tie, if the stock itself does not make a strong grip upon it, and all injuries to the bark by the insertion and all cut surfaces both of graft and stock covered with grafting wax, which accomplishes practically a complete exclusion of the air.

Another difference between budding and grafting is in requisite condition of the "stock"; in the former the bark must lift or slip freely—the condition a boy requires to make a whistle; in the latter this condition is neither requisite nor desirable.

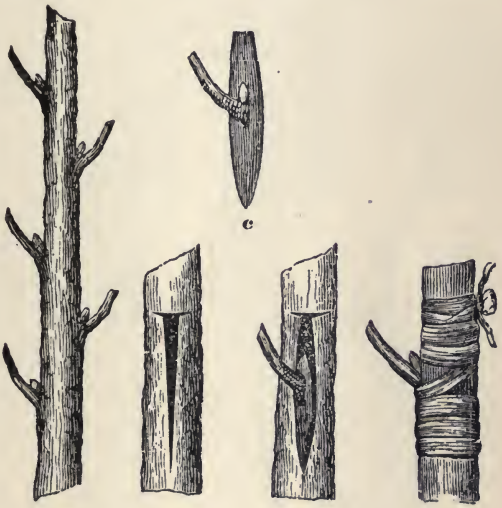
If these essentials are secured one may have wide liberty of methods in applying them and that is the reason why individuals have so many preferred ways and why all nations of the earth have methods which are characteristic and sometimes widely different from each other, and yet all nations are good grafters—in a horticultural sense.

Methods of Budding and Grafting.—The scope of this book does not admit of detailed descriptions and discussion of methods. The reader can find interesting suggestions in horticultural books in all languages. A

PLATE 5: "THE BEST WAY TO GET A SMALL GREENHOUSE IS TO BUILD IT YOURSELF"—PAGE 82.

few simple forms, which constitute those in widest use, will be presented with illustrative figures:

The adjacent engraving illustrates the method of budding most commonly employed, to be practiced when the stock is in proper condition of sap-flow, as already described. It consists in lifting the bark and inserting a bud from another tree in such a way that the inner bark of the bud shall come in contact with the layer of growing wood in the stock, and then it



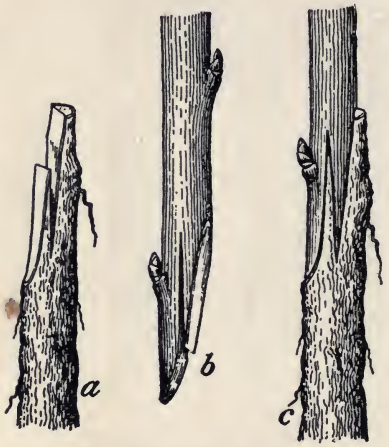
Shield-budding illustrated.

will be quickly knit to it by the sap, if the bark is closed around the inserted bud closely enough to prevent the air from drying the two surfaces at the point of contact.

In the engraving *a* is the cutting or "bud stick" from the tree of the kind into which it is desired to transform the seedling. This cutting is to be made from the growth of the present season, which has well-formed buds at the axils of the leaves. If buds are desired to mature early, pinch off the ends of the shoots from which they are to be taken. In budding, select a smooth place on the bark of the stock and make a horizontal cut, and then a perpendicular cut downwards toward the roots, as shown at *b* in the engraving, with the bark slightly lifted and ready for the insertion of the bud. Next cut from the bud stick a bud, as shown at *c*. This

carries a small portion of the wood of the bud stick, back of the bud, which it is not commonly desirable to remove. Insert the point of the bark below the bud in the slit in the bark of the stock and push it into place, as shown at *d*. The bud and stock are then wrapped with soft twine or a strip of cloth or raffia, as shown at *e*. If the bark carrying the bud retains its natural color and does not shrivel in a few days, it is said to have taken and the wrapping should be loosened a little, but not removed. When growth starts freely, the wrapping is removed and the stock cut away about half an inch above the growing shoot.

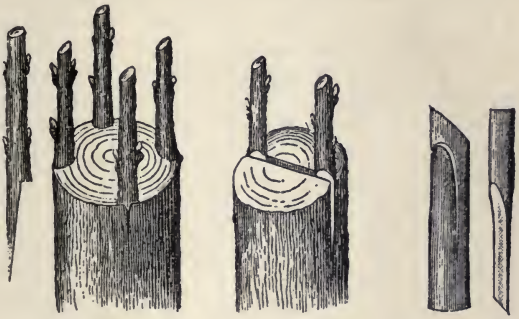
Grafting Methods.—Illustrations are also given of several popular methods of grafting, the ways to shape the scions and to make the cuts or



Whip or Tongue Graft—a, cut in stock; b, cut in scion; c, scion in place.

splits in the stock being sufficiently indicated by the drawings. The wrappings in the case of grafts should be more firmly applied because usually new growth will be considerably postponed and because the cleft wood needs to be firmly held to contact with the scion from which it is apt generally to part by shrinking or drying. To aid in preventing this, and to exclude air so that the scion shall not perish by drying, waxing is almost always used in grafting above ground. Good wax is sold in cakes or packages by seedsmen and the amateur will usually need too little to warrant cooking up the ingredients himself. The writer has always found it very convenient to have on hand a wide-mouthed bottle of liquid grafting wax, made as follows:

Melt one-quarter pound of resin over a gentle fire. Add to it one-quarter ounce of beef tallow, and stir it well. Take it from the fire, let it cool down a little and then mix with it a teaspoonful of spirits of turpen-



Graft in Bark. *Cleft Graft.* *Side Graft.*

tine, and after that add about two ounces of very strong alcohol. The alcohol cools it down so rapidly that it will be necessary to put it once more on the fire, stirring it constantly. Great care is necessary to avoid igniting the alcohol.

This wax is easily prepared, and when well corked will keep for months. It is put on the wounded part of the tree, and the tip of the scion, and soon becomes as hard as stone. It is valuable not only for grafting,

Cleft Graft at Root-Crown.

but for covering the scars caused by removing limbs in pruning. A fairly good liquid wax may be made by omitting the turpentine in the above formula.

Carrying Cuttings Long Distances.—Hard wood cuttings for rooting and for use in budding and grafting can be carried considerable distances by packing in damp moss in an ordinary wooden box which gives some ventilation, or they will also go very successfully without any moss, if packed in a hermetically sealed tin receptacle. The latter method is, in fact, the safer, as guarding against molding, and perfectly sure to carry, providing entrance of air is prevented by soldering in a tin can. A few buds will carry in a tin box or canister with an ordinary tight tin cover. If air can be excluded the cuttings are better without any wet packing.

CHAPTER IX.

HOT-BEDS AND COLD FRAMES.

Efforts for the multiplication of many plants by seeds or cuttings are promoted by arrangements for regulation of temperatures and of moisture both of soil and air. This regulation is also essential to the success of buds and grafts of tender plants—especially when working in soft tissues, as suggested on page 65.

It is obvious that in California, where the temperature never falls as low as in lands with wintry climates, the arrangements for securing artificial heat, even for the growing of the tenderest plants, are very simple and consist, for the most part, in concentrating and storing winter sun-heat and preventing the intrusion of night temperatures. Even where artificial heat has to be actually produced, by circulation of hot air, hot water or steam, or by the rising of heat from fermentation of manure, but a few degrees of elevation of temperature are required and arrangements altogether inadequate in wintry climates are quite sufficient in California, in all but the high mountain districts. For these reasons in all amateur operations very simple, home-made, appliances are perfectly adequate.

HOT-BEDS.

Hot-beds used in California are exactly similar to those used in colder climates, but they need less protection from outside temperatures such as is obtained by banking with manure and covering with mats, etc. They also need less active heat, such as is produced by partly spent manure or by using a smaller mass of fermenting material and they require, perhaps, greater watchfulness against over-heating and freer use of ventilating arrangements for admitting outside air. They also require attention to shading for even the California mid-winter sun is sometimes very fervid. Thus, though the construction of hot-beds here is similar to the traditional structures of colder climates, the use of them has to be guided by local experience and observation.

The construction of a hot-bed is indicated in Fig. 1. It is made of two-inch planks, spiked or bolted together, though for most uses one-inch redwood boards will serve as well as planks. It is in the form of a rectangular box, generally 6 ft. wide, because that distance is readily reached across from the sides, and as long as desired. The box should be so made that when the bottom is level, the sash will slope 1 in. to the foot, which will make it 6 in. higher on one side than on the other. This slope permits the sun's rays to enter more freely and allows water to run off quickly. The bed should be located

on a southern slope if possible and run east and west with the lower side of the frame toward the south. If a southern exposure cannot be secured, a windbreak may be constructed on the north side and the ends to shut off the cold winds from these directions. The beds should be near a plentiful supply of water in order that the plants may be carefully and easily cared for. It is essential that a hot-bed should be located where water will not collect from rains or watering. Water must not stand in the soil occupied by the plants nor in the manure below. The whole outfit must be well drained.

Common horse manure containing no litter, mixed with from ⅓ to ½ its amount of straw or leaves, is used for providing artificial heat. Straw or leaves are added to prolong the heating period of the manure and to keep it from heating too violently. The manure is gathered fresh from the stable, piled up and allowed to heat. Before fire-fanging, however, it should be moistened and forked over and

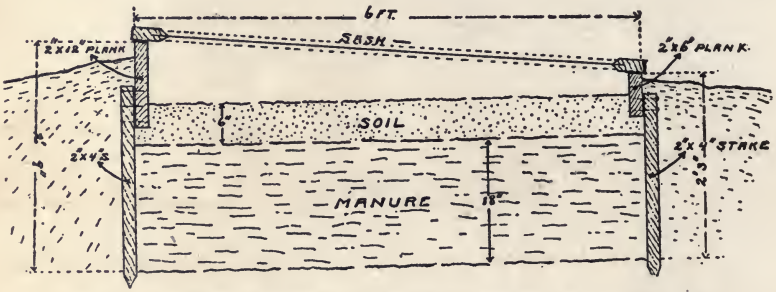


Fig. 1. Sectional View of Hot-Bed Construction and Filling.

allowed to heat again. During the heating it should be kept under shelter as heavy drenchings make it almost worthless. After it is well heated through the second time, it is put in the hot-bed excavation almost to the sash level, care being taken to spread it evenly and to have the corners well filled. After the manure has again warmed up it should be firmed by tramping. The bed is now ready for the soil.

Usually seeds or cuttings are put into the soil bottom of the hot-bed to get more direct effect from the bottom heat although seed boxes or flats are also used over the heating medium. In the former case five or six inches of rich soil containing much humus and sand are placed upon the manure and after the temperature of the soil has dropped to 90°F. most seeds may be sown. A good soil can be prepared by making a compost heap consisting of alternate layers of good surface soil containing grass roots if possible and barnyard manure, 8 or 10 months before it is to be used. This will give a loose, rich

soil very well adapted to hot-bed work. It is not necessary, however, with our abundance of good sandy loams to delay for such preparation. Any good garden soil with enough sand and fibrous material to take water well without baking will give good results.

THE COLD FRAME.

The cold frame is essentially a hot-bed without the heat. It depends entirely upon sun heat and protection from the chills of the night. It may be of lighter construction than the hot-bed and in ordinary use it is an advantage to have it easily portable or capable of being easily knocked down and set up again. Fig. 2 shows such a frame covered with sash and another covered with close-textured white cloth. Either of these frames can be also used as a hot-bed by tramping several inches of manure into it after it has been placed or

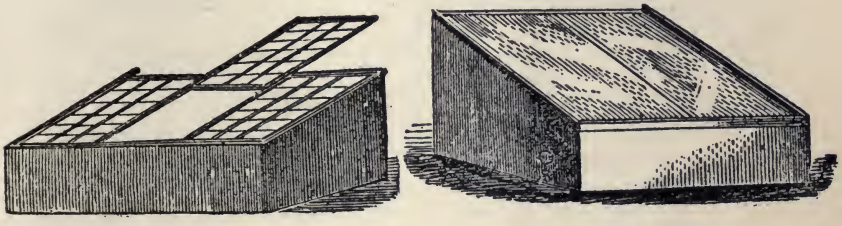


Fig. 2. Cold Frames With Glass and Cloth Covers.

a wide heap of manure can be made on the ground and the frame placed upon the top of it. Under California climatic conditions this simple recourse may be substituted for the more elaborate construction of a good hot-bed.

But the cold frame is generally used without artificial heat. Seeds may be sown in the soil-floor of the frame or they may be sown in flats or in seed boxes for ease in taking up for planting out. Seedlings from hot-beds are often transplanted into cold frames for hardening-off before planting in the open. Care must always be had not to allow too much sun-heat even in a cold frame and partial removal of the covering during the heat of the day is usually desirable. The substitution of a lath cover for the glass or cloth is a good recourse as the season advances. By giving spaces equal to the width of the lath, a half-shade is secured.

Cold frames, Fig. 3, are often used in great area for growing vegetables or flowers out of season and in that case boards are held in place by stakes. Such frames are easily placed over perennials as

they stand in permanent place and a degree of forcing secured after which the frames are removed and the plants allowed to make their later growth in the open air. Violets, etc., are often profitably forced

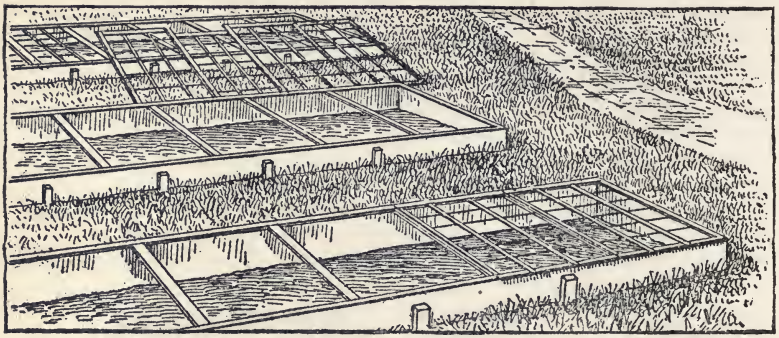


Fig. 3. Portable Cold Frames to Use on Plants Growing in Place.

in this way. One of the pictures shows cold frames placed in this way on a sloping piece of ground, the natural earliness of such a slope being hastened by such slight protection.

COVERING FOR HOT-BEDS AND COLD FRAMES.

Glazed sashes are best for covering hot-beds and cold frames though white cloth is used with great satisfaction. The glass in California even in the winter should be whitewashed to prevent too great concentration of sun heat, or too great radiation of heat at night; or a lath or cloth cover should be at hand for day or night use. It is often desirable to remove the sash during the day time and cover with the lath frame. In exceptional cold spells an old carpet or burlap cover may often be used to advantage at night. When covers are used which are tight like glass or cloth, great attention must be given to ventilation for it is very easy to allow the heat to run high enough to kill the plants or to produce conditions favorable for "damping-off."

In the case of lath covers or of lath-houses which are often used as shelters for seed beds and seed boxes, the space between the laths should be the width of the lath which gives a half-shade. The lath should run diagonally, whether the cover be used nearly flat or standing upright like the side of a lath-house, for this tends to shorten the exposure at particular points. Sometimes the lath can be a little wider spaced and on one edge of each lath tack cheesecloth in strips

of 3 inches wide to hang down like drapery. This will give free ventilation and permit of proper light conditions. Wire can be used in place of lath and the strip of cloth pinned on.

Cloth can be made serviceable for some time as covers by waterproofing. Stretch the cloth tight on the frame. Melt 4 oz. paraffine in a pan on the stove, then carry it out doors and add one quart of gasoline and mix. Spray or paint the mixture on the cloth. The gasoline will evaporate and leave the cloth well waterproofed by the paraffine. But though covers are important, it must not be forgotten that a properly adjusted touch of the sun is essential to most plants. In many cases the cloth and lath shades of our seed beds in California do not have sides or ends; they are simply umbrella-like, and moss will form even with full circulation of air if the shade is too dense. For instance, we can get plenty of moss on the ground surface on the north side under the shadow of the dense head of a Phœnix palm and none on the south side of the same plant. The air is free to circulate on one side as on the other, but the dense shade keeps the surface continually damp on the north side, and there the moss appears. Unquestionably aeration is exceedingly important in closed-in seed beds and frames, but just the right touch of the sun is a great thing also.

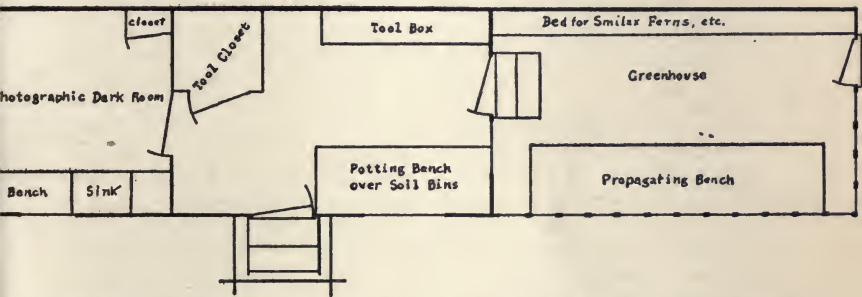
CHAPTER X.

THE AMATEUR'S GREENHOUSE.

Reference to a greenhouse of such style as a working amateur can easily build for himself does not warrant the reader in expecting a general discussion of the growth of plants under glass. In this connection the greenhouse will be considered only as a very desirable and helpful adjunct in the propagation of plants to be grown in the open air, or, possibly, as a sanitarium where plants wearied by use in house decoration may be induced to perk up again by soil-treatment and by sojourn for a time in more equable temperature and moister air. Even for such simple uses the amateur's greenhouse gives great satisfaction at very low cost, because in California it can be very slightly built and does not require artificial heat so long as it is restricted to the growth of temperate and semi-tropical plants. There may be a few nights in the year when one may be inclined to borrow a small portable heater from the house or turn on a few incandescent bulbs or even install a handful of promotion pamphlets,—thus releasing enough hot-air to rule out danger from frost under glass which is kept whitened and thereby checks radiation of heat stored from the previous day's sunshine. For in California valleys generally and largely in the coast region also, the glass will need to be always kept somewhat whitened against too ardent sun-heat. We have no trouble from inefficiency in winter sunshine and no need to clean the glass to get the last ray of it. If freshly whitened at the close of the rainy season the fall rains will thin down the coating so as to be about right for winter. Therefore, it is only a small house which has no heating system but is operated largely by sunshine, with occasional recourse to covering perhaps, or to a little bottom heat from a lamp under a seed or cutting box, which is contemplated in this discourse.

How to Get a Small Greenhouse.—The best way to get a small greenhouse is to build it yourself—you can get more satisfaction at less cost than in any other way. To present a concrete demonstration of this great truth the writer will draw upon his own experience. When the contractor had finished enlarging and repairing the house, some years ago, all the odds and ends of lumber, etc., were bought for a song and from the lumber pile in the back yard thus secured, the construction of a combined tool house, dark-room, potting shed and greenhouse, was entered upon. All that was actually purchased as new material was the sash bars, glass, a little hardware and roofing-paper for the part not covered with glass. The total outlay for new materials was less than $35. A few old doors from the lumber pile

came in handy and the covering of the building was done with old shingles—recovered from the re-shingling of the residence. They were turned when re-laying and their beautiful bronzy coloration was the envy of all the stained-bungalow builders of the neighborhood. No estimate is made for cost of labor, because not a professional hammer-stroke fell upon the building. To give the reader a definite idea of the affair a ground plan is presented herewith, drawn on the scale of one-eighth inch to the foot, so that one can easily calculate the sizes of the house and its subdivisions and any builder can give a bid for the construction of it, if the amateur prefers not to build it for himself.



Ground Plan of Amateur's Green House—See Plates for Exterior and Interior Views.

As the writer never had another greenhouse, he cannot particularly recommend this one as having any superiority in form or dimensions. It was built to fit a space and to favor construction with the character of the available materials. Its form is however probably approvable from the point of view of securing strength with light construction and of full illumination wherever desired. Its general appearance, external and internal, is presented in other engravings, which, taken in connection with the ground plan, render descriptive comment unnecessary.

The interior view shows the boxes for seedlings and for starting small cuttings mentioned in a previous chapter. For propagation alone, it would be better to have the glass lower; that is nearer to the sand surface. But for amateur uses it is desirable to have more head-room and greater elevation for the benching of potted plants, so this distance was chosen to meet both purposes. Ventilation is furnished by openings under the glass on both the high and low sides of the house and by opening end doors when the sun heat runs

too high. The main building has sills set on concrete blocks at short distances. The greenhouse part would be better if framed upon brick or concrete walls, but the writer is not even an amateur mason and so the sides were nailed upon uprights set in the ground like fence posts. The only defense for this is that redwood posts are apt to last for a generation and one would be ashamed to build a cheap greenhouse for his grand-children.

All that is urged in support of the amateur effort is that it works and gives constant satisfaction. It is a great comfort to have a place always ready to receive a seed or a cutting no matter what outside conditions may be;—also to have plenty of everything right for planting out when the best time comes for making a start or following for succession.

The structure also furnishes what every amateur should have—a place for tools and garden supplies instead of having them stand in entries or back hallways or fighting the cook for closet room, which is apt to make a man desperate enough to leave everything out in the weather, which is not a good plan even in California.

The photographic dark room in an outbuilding is also handy for all who are votaries of the camera for then they can slosh water and chemicals around freely without criticism. As however this is not a floral affair, the cost of its fittings are not included in the estimate of low cost in this particular structure, as given above.

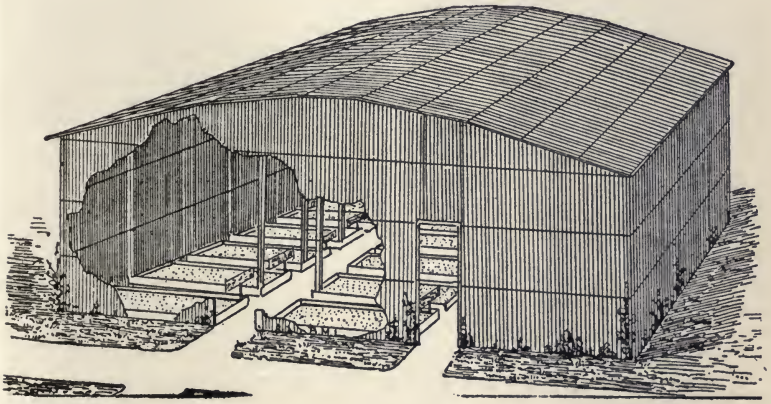
Whitening for Greenhouses.—Although the writer's experience has been as stated, viz: that in California the winter sunshine is too ardent for plants under glass and therefore he uses a durable whitewash which is never fully removed by the rains, it should be stated for the benefit of those living in shady places that the best removable whitewash is made of three parts air-slacked lime to one part Spanish whiting and enough water to put on with a brush without running. If it is not thick enough give another coat after the first has dried. This mixture is very easy to remove in the fall: you can wash it off with the hose if the rains are delayed.

Temperature in Greenhouses.—Although this discussion does not include greenhouses with heating systems, sometimes the sun will heat a small house unduly. It is a mistake to let the temperature rise to 90° or 100° and then open the ventilators and doors, and in less than five minutes cause the temperature to fall from 20° to 30°. It has injurious effects on plants. The nearer you can keep the temperature to 70° the better the plants will grow, and instead of having tall, spindling, soft, long-jointed growth ready for the attack of disease, you will have strong-stocked, hardy plants that are not so subject to disease, and such plants will winter better even if the temperature goes below freezing. Open the ventilators in the morning when the ther-

mometer shows 70°, and close them in the afternoon when it drops down to 70°. On a very hot day you can keep the temperature down by repeated spraying of the floor, sides, etc., as it cools by evaporation. At such a time it might not be desirable to wet the plants.

Of course citation of these temperatures will be looked upon as a joke, in some interior valleys in the summer, but they may be comfortable to read about even there. If you cannot do as well as prescribed, do as well as you can.

Watering Greenhouses.—Although there may be advantages in watering open air plants at night, it is not always true and it is apt to be the other way in a greenhouse. As a rule if water is to be applied to the foliage of plants in the summer season it should be during sunshine and it should dry away before night temperatures come on. Some plants are quite apt to mildew if allowed to go into a chill with wet surfaces.



One of many forms of Lath Houses.

Greenhouse and Lathhouse.—Although the lath house belongs, structurally and otherwise with the cold frame and has already been mentioned in that connection, it has also close affiliation with the greenhouse in all commercial affairs and is worthy the attention of the amateur in the same way. Probably the next indulgence of the writer will be the extension of his building toward the right (see ground plan) with a construction of the same dimensions as the greenhouse, but with roof, front and end covered with lath: the interspaces equal to the width of the lath, giving half-shade. The entrance to the

greenhouse will be through this addition and the potting appliances and materials will be moved to this lath house—leaving the bench now used for potting for mechanical recreations. More smilax, asparagus-fern, etc., will be grown for house decorations on the fence-backing up the lath house and room will also be afforded for the growth of chrysanthemums, carnations, ferns, etc., with semi-protection and at a little lower temperature than that of the greenhouse in the summer and autumn. Such plants grown in pots are available for house use when in their best estates.

In the warmer interior valleys of the state the lath house is more valuable than on the coast because of its half-shade and the moderation of summer heat, while it also is a safeguard against ordinary winter frost-injuries in such places. In the hot valleys the lath house is probably of more practical value to the amateur than a glass-covered greenhouse, although the two work well together everywhere. The fiercer the heat and the brighter the sunshine the closer the lath can be brought together and a three-quarter shade will often give quite enough light for ferns and many other plants. In this way the partial covering of the lath house with beautiful annual flowering vines or with deciduous perennial vines is rational, for the vine-shade, which might be too dense in winter, disappears. By such use the lath house may become ornamental as well as useful.

CHAPTER XI.

PLANTING, PRUNING AND TRAINING.

Except in places where rock, clear sand or clay may make it desirable to open a considerable excavation to remove bad stuff or to mix better material with it, it is seldom necessary to dig large holes for planting anything. Small plants, set with trowel or dibble, or larger plants, set by throwing out a few spadefuls of earth will do quite as well as if placed in large excavations—if the soil is good as described in Chapter III and well prepared to meet the requirements outlined in Chapter IV. The purposes of those chapters is to make the whole soil-mass of the garden good and then new plantings will not require rifle-pits—which are always expensive and often dangerous because they favor the formation of subterranean mud-puddles, which very few plants like to grow in, and will keep out of if they can. And an established plant is much better able to keep its roots out of the mud than a newly-set plant is to gain establishment in it. In a deep, well-drained soil or in a shallow soil, if hole-drainage is provided, one can sometimes get a greater development of plant in a given time by digging cellars and filling them with plant food and the policy thereof may be commended to gardeners who have hurry-up employers, or to park planters who have restless city-fathers to serve, but both these problems are professional and therefore out of our line. To the amateur such procedure is generally a temptation to put his faith in a hole and to neglect other important things which should be done after planting.

Firmness in Planting.—The conditions emphasized as desirable in preceding chapters in the planting of seeds and cuttings, and in transplanting seedlings, are applicable to the planting out of older rooted plants of all kinds. Firming the lower soil into close contact with the roots, and leaving the upper soil loose for exposure to the air are essential to success. Both are concerned directly with the maintenance of moisture in the soil, which the plant is first to use in its re-establishment, and with the proper, but not excessive entrance of air for root-activities. The amateur is apt to be too gentle in his planting. It is not well to act as though you were disposing downy coverlets upon the limbs of a sleeping babe; it is better to press heavily with your foot upon the soil next to the roots—as though you were trying to stamp the life out of the brat. If the spot has been properly prepared for planting, it is deeply loose and the pressure is necessary to restore firmness at the root-place, the balance of the earth may be left to re-assume a proper condition at its leisure—which it will surely do by natural processes.

The Use of Water in Transplanting.—It is particularly desirable in transplanting in light soils, and in any soil at dry times, to use water in transplanting. This not only adds moisture for the safety of the plant, but it water-settles the earth, making such contact with the roots as has been prescribed. In such practice the plant should be put in place, the earth sufficiently compressed by hand or foot to hold it at about the proper depth and upright, and then a few quarts or gallons of water poured into the hole, according to the size thereof. There should be water enough to act upon a relatively considerable mass of the loosened lower soil. In planting in rows a hoe or plow furrow may be drawn along the line, the plants properly placed and firmed and water run in the furrow to avoid carrying. When the water has disappeared and before the soil dries to baking or cracking, the loose soil should be hand-drawn or cultivated over the moist soil and no pressure applied.

Treatment of Roots at Planting.—It is not at all necessary to make supreme efforts to get all the roots of a plant when lifting for replanting. From a few inches to a foot is usually quite enough for any plant of a size which a man can handle alone. Moving larger growths will be discussed in the chapter on trees. Nor is it necessary to save all the fibrous roots; if the transplant is balled, that is if it is taken up with a ball of earth enclosing the roots, the fibrous roots are saved in the process, and in moving woody evergreens this is a desirable thing because an evergreen is always using more or less sap and is apt to quickly perish by drying, but deciduous plants, which can endure considerable drying when free of leaves, and herbaceous plants which start growing immediately in a new place and thus supply themselves at once, do not require all the roots you can get—in fact a better plant is usually made when a good part of the roots are removed. Roots wounded by digging up should be shortened to a point above the wound, and masses of rootlets, which would prevent soil contact with larger roots, should be clipped away.

Plants which have grown too long in pots are liable to have twisting roots, like a corkscrew, and when planted as they come, may blow over for lack of lateral or supporting roots. Sometimes such roots can be disengaged and straightened but if not it is often desirable to take a sharp knife and cut down through these twisting roots before planting, and the plant will throw out good supporting roots that will hold it against ordinary winds and storms. Some ornamental trees have been condemned because they had bad roots and blew over. They had been taken out of boxes and pots without cutting the roots which circled around and could not hold up the tree.

Depth of Planting.—The plant should usually stand in the new place at about the same level it previously occupied and if this cannot be

PLATE 6: "THE INTERIOR VIEW SHOWS THE BOXES FOR SEEDLINGS AND FOR STARTING SMALL CUTTINGS"
PAGE 83.

told by the earthstain it is generally disclosed by the aspect of the bark. In a light sandy soil a plant may generally be planted a little deeper than it stood in the nursery and in a heavy soil, disposed to be too wet, by nature and drenching, it may be planted a little higher, but there is always danger of unthrift by much change from the depth at which the plant previously grew.

Reduction of the Top Growth.—Unless the plant be a woody evergreen the characteristic shape of which it is essential to preserve (and moving with a ball of earth is prescribed for such) it is desirable to prune away half or more of the top growth at transplanting, to allow for the break of a smaller number of buds and to secure more vigorous growth from them. This is the ultimate motive for cutting back although it is generally expressed in terms of helping the plant to live; the real reason is to help the plant to live well, from your point of view. Therefore cutting back should be done always with regard to the symmetry of the new plant; not arbitrarily cutting back everything, say one half, but removing many shoots entirely and reducing others less, perhaps, if that will make for a good form. Any plant ought to be glad to lose its dangling arms to save the length of its ears; if that is what you desire. However, cut back and promote a stronger growth in directions which are to be preferred—and then give the plant food and drink and soil stirring to make that strong growth possible.

Shade After Transplanting.—Although the necessities of commercial work require transplanting seedlings or rooted cuttings at all hours of the day, the amateur may usually choose his time and for taking plants from shelter to the open ground the closing hours of the day are best because the transpiration is less in the cooler hours of the night. This refers, of course, to evergreens and herbaceous plants especially. Sometimes one can wholly avoid a wilt of the plant by working on a cloudy day or in the evening, and spraying after planting. In any case shading the leafy plant from direct sunshine for a time is desirable. For small plants perhaps nothing is better than inverting an empty flower pot over them. The hole in the bottom of the pot will give them all the air they require. For larger plants, inverted boxes, shades of paper or cloth, or other shadow-devices, are worth more than the trouble of providing them.

PRUNING AND TRAINING.

It may be necessary to give explicit suggestions for pruning and training different plants in the later chapters which will be devoted to them. In this place a brief suggestion of the general purposes of pruning may be made.

The chief purpose is to secure a strong growth of the plant capable of foliage and bloom which is characteristic of the particular plant in its best estate. Therefore the ultimate purpose indicated above as belonging to cutting-back after transplanting, must be steadily held in view in treating an established plant, for the same preponderating force in the root must always be striven for. In the established plant, pruning is not to get more growth. Observations have demonstrated that one is apt to get more inches of new growth on a thrifty, established plant by not pruning. But the growth is less capable of good foliage and bloom. Therefore fewer inches with greater thickness and capability is desirable. To that end, pruning is indispensable and is effective if one does not neglect to give the plant what it needs to make such growth; and, even under a degree of hardship, the pruned plant pleases better because its force is concentrated. Therefore the chief purpose of pruning is served by removing or shortening slim growths always— by reducing or shortening stronger growths to cause the development of better new growths, when the habit of the plant is to proceed from leaf to flower from the same bud-break, and to serve the same purpose, when several bud-breaks are expected in a season by pruning as many times as such breaks are expected to appear. Therefore a gardener should be always thinking and always pruning. He should usually do some pruning every time he cuts a bloom, he can even have a thought for the force of the root when he cuts a bloom-stem from a bulb. Therefore do not ask a friend "is it the time to prune now"? It is a time to prune whenever there is a reason for it, clear in your head. It is just as important to have your thought sharp as your shears.

Another purpose in pruning is to attain or retain proper form and symmetry. To practice this one must have a proper conception of symmetry in his head and foresight to prophesy the direction and character of the new growth, which is to follow. This can only be attained by observing and thinking; it can only be hinted at by conversation or writing. If you say to an expert friend: "Please tell me how you prune roses," he will probably be somewhat flustered and say: "Oh, get rid of a good part of the old wood and shorten the new growth about one half." It is about as good a general statement as one can make, but it requires a study of the bush itself to decide what old wood should go and what should stay to support the new and to decide also whether a new shoot should go entirely or whether a half, a quarter or a single bud of it be retained. Aside from the purpose in the preceding paragraph, that purpose has now to be reached by way of securing good form also. Pruning for form is a kind of sculpture and no one can become a sculptor by getting a recipe to knock off half the marble.

Another purpose in pruning is to secure symmetry in combination with abundance of bloom. Those plants which bloom from the old wood directly must of course be learned by observation and pruned in a way not to lose this while serving other purposes. Some of these are tip-bloomers and these must not be shortened but enforced by reducing the number of shoots when they are crowding each other out of light and air.

These are but a few of many general considerations involved in pruning. Their character, however, sufficiently indicates that pruning is a process of original perception of facts about the particular plants to be treated and original conception of ways to help them meet your notion of what is their best performance. They can hardly be expected to abandon their natural purpose but they will serve yours generously if you will think enough to issue intelligible orders.

TRAINING.

The term training is best applied to treatment of garden plants which grow with artificial support of some kind. The purposes already cited for pruning self-supporting plants hold also with those which are trained and become even more important, possibly, from some points of view. It is the writer's observation that prevalently in California plants which require pruning are better served than those which require training but the discussion of that matter will be relegated to the chapter on Vines.

PLANT STAKES AND TIES.

As pertaining to the support of all kinds of plants and therefore desirable to discuss in this place once for all is the subject of plant stakes and tying materials.

The wooden stake, such as the amateur can point and paint in quantity in his workshop on a rainy day, are too well-known to require comment. Of a dark-green color they are very praiseworthy. Dark green stakes with white tips are very neat but too artificial and conspicuous although they may be claimed to be simulacra of green plant-stems, flower-tipped.

For serviceability and inconspicuousness, the writer has found nothing to compare with iron stakes made by cutting up small gas and water pipe into lengths of three and four feet. Local plumbers usually have old pipe from house repairs which they will sell at a fraction of the cost of new pipe and since the fire of 1906, San Francisco has been a mine of such material which has become a specialty with junk dealers. The writer has had four or five hundred old-pipe stakes in use for fifteen years or more and they are still serviceable: being pulled up and re-set as required. They can be driven into place, even in

hard ground, without making a hole. If deeply driven they are capable of supporting a tall standard plant through a gale of wind.

For lighter uses, such as supporting tall herbaceous plant stems during blooming, mature canes of one of the smaller bamboo species are very desirable and can be taken at any time from a clump grown primarily for its beauty, as will be noted in a later chapter.

In addition to the use of ordinary twine, small rope, etc., for tying plants to their supports, two other recourses have given long satisfaction. One is the common use of galvanized wire, thrust through a piece of refuse garden hose, which should be kept for this purpose when beyond other uses. If the hose is cut to the right length a very neat support can be made by twisting the wire at the ends with pliers and the bearing upon the hose will prevent injury to the bark. Another good material is second-hand insulated wire which the electricians often have more than they care to gather up. The heavy wire, which with its insulating coating is about a quarter of an inch in diameter, is strong enough for heavy strains and there are many lighter insulated wires in a common job-lot. It is a good plan for the amateur to gather-in a bushel of it in assorted sizes from the electrician's bargain-counter.

But for most constant use in tying plants large and small, from a holly-hock to a campanula, also for tying bouquets, etc., every garden should grow its own ties, so that hunting for twine need never be necessary. Such a plant is New Zealand flax (Phormium tenax). The leaf, simply torn up into ribbons, furnishes strong bands which become even stronger on drying, and they can be trusted to hold for a long time. This plant grows very freely in the coast region and in the cooler, moister parts of the interior valleys and can be grown in a corner although it is really a handsome plant.

The dry leaves at the base of the head of a dracæna (sometimes called "yucca palm") are good for tying and there are always some on the tree even if you have cleaned up all that fall to the ground. If you wish to prepare a lot in advance, gather up the dry leaves, soak them in hot water and then tear them into strips, about five from one leaf, and they will be found pliable and durable—being disposed to hold on for months. You can also use these withes for coarse basketry if you are inclined that way.

PART III: THE CALIFORNIA GARDEN YEAR.

CHAPTER XII.

CHARACTERS, ADAPTATIONS AND REQUIREMENTS OF THE MONTHS.

There are various reasons why the attempt to prescribe specific things to be done in particular months of the year, is difficult in California. First, there is the difference in climatic conditions in different localities which may render some prescriptions unfit for certain places, while they may apply well in others. Second, there may be variations in seasons which may render a prescription suitable for one year and not exactly timely for another. Third, there is, in most California regions, an absence of extremes of heat, cold and of excessive moisture and a lack of association of either with definite dates. In fact what are commonly called, in wintry climates, "well-marked seasonal changes" do not occur in California, except upon the mountains, and we have, instead, a gliding movement from one to the other of our two seasons, a lack of definiteness in the beginning and ending of each and an absence of marked difference in heat between the two. Such a moderate climate gives a plant a great latitude in its acceptance of growing conditions and bestows upon him who grows plants a long period during which he can successfully minister to their requirements. Considerations of this nature have already been outlined in Chapter II. We have to repeat reference to them in connection with our effort to indicate the timely duties of the different months, to reduce if possible the reader's displeasure at our indefiniteness. The fact is that California climatic conditions give so many chances of being early, so many chances to catch up if not too neglectful and so many chances of reasonable satisfaction even if late, that the precise reader will search in vain to find designation of the one exactly best time to do a thing. As has been indicated in the chapter on climate, one characteristic of the state is a very long growing season and therefore there may be, taking the years together, no absolutely best time, but several very good times. The conclusion for the reader, therefore, must be not to refrain from doing a thing, because no exact time is designated as best, but to keep doing things at different times and thus enjoy the full breadth of reward—for this comes, as the scripture saith, to those who do not weary in well doing.

Out of respect to the ancients we begin the roll-call of the months with January. Really one month would do about as well as another for a starting point. In prescribing activities for the months

in another line of horticulture* the writer has chosen to begin with July, chiefly because that is the point in the dry season between two rainfall-years, which is designated as a starting point by the meteorologists, but growing plants, if furnished with adequate moisture, pay no attention to it. January is a central point in the rainy season but is also a divide in the temperature record. It usually shows the lowest temperature of the twelve-months, but not low enough to stop growth and blooming, except the few plants which actually tolerate no frost. With a whole year as a continuous growing season, for all plants except these few and others which persist in the deciduous habit, one naturally cannot find dormancy to start from and we therefore respect the precedent of the ancients and the convenience of the moderns, with whom the opening of a new year is a point of beginning and of making good resolutions—of which a garden should be one.

JANUARY.

January in the California garden is a month of limitations, but of opportunities also, for though open-air blooms are relatively few, they need not be absent. Observation of suburban gardens will demonstrate the fact that California has no flowerless month. But January certainly has trials for the gardener. The rains may be continuous and cold, in places of largest precipitation, and the ground become so full of water that planting is not wise, and there may be films of ice which show that the temperature is too low for tender plants, and yet, even in such places, the Japanese quince will clothe its dark branches with ruddy brilliance; the flowering almond will almost conceal its light green twigs with snowy bloom, and the camellia will contrast its dark green foliage with a wealth of white, pink, red and variegated rosettes which strive to atone for loss of fragrance by excess of formality. Many other shrubs will also serve the planter who desires to gather January flowers, while those who only plan for flush seasons of most common growths may have gardens scant of beauty, except the glory of the geraniums, which never resent neglect.

But regions of heaviest rainfall and frosts do not measure the January possibilities. The thermal belts in nearly all parts of the state have much light, warm soil, which quickly frees itself of surplus water, and in such places even slanting sunbeams arouse a host of both woody and herbaceous plants to blooming. In such places also hardy deciduous trees, shrubs and flowering plants can be freely transplanted and cuttings of shrubs and vines started on their courses. In fact, in the drier parts of the state, where winter temperatures are high, January is one of the great planting months of the year, because an early

* "California Vegetables," Chapter X.

start is very desirable in preparation for later resistance of heat and drouth.

Still other situations there are where January is practically a closed month, even in California. In the mountain valleys there is real winter, though it be but short, and in some low lands there are such sharp frosts and excess of water that it is better to wait than to work and worry. The California gardener must learn to recognize conditions and to apply principles rather than try to work by the almanac. For this reason the effort has been to make the injunctions of this California Garden Calendar suggestive and not didactic. There is the widest liberty in California to the gardener who proceeds by sound judgment of the mutual relations of soil, moisture, heat and the requirements of different plants. Here also are the keenest disappointments for those who proceed upon unreason or cherish the notion that a glorious climate favors horticultural license.

As in some parts of the state January is the month of least activity in the garden, it should be the most active in thought and study about gardening. Nearly all good treatises on horticulture contain statements which will be suggestive for California effort if close thought on the correlation of conditions be undertaken. Thus, in a sense, all horticultural literature becomes helpful in California if one uses it aright, because California is really an embodiment of the horticultural possibilities of all zones except the strictly tropical. The realization of this quality of the state enables one to understand California gardening, and reduces to a minimum the requirement of actual experience, which is essential to success.

Particularly valuable in designating plants which have become so popular as to be widely salable, and therefore worthy of planters' attention, are the catalogues of the California seedsmen and nurserymen, which often contain also pertinent suggestions of local practice. All of their promises may not be realized, because they are apt to speak of a plant at its very best, and common conditions do not often allow it to reach this high estate. There are sometimes overestimates of the quality or suitability of novelties, but everyone should have a profit and loss account "limited," with novelties, and charge as cheerfully to one side as to the other, because the cautious one will regulate indulgence so that the balance will be on the right side and represent either accomplishment or wisdom. But here again the favoring California conditions protect the planter. Ten novelties will probably succeed here where one is found worth growing in more trying climates.

In the way of specific suggestions it may be said that, as conditions favor, the activities which began last October may be continued for much later effects. Where the garden is in January a mass of bloom from early fall planting it is timely to plant the same things for bloom in spring and summer. This will include both annuals and perennials

from seed or from transplanted seedlings or roots. Even the winter flowering bulbs may still be planted with bulbs kept dormant by the dealers, and the summer flowering bulbs, such as gladioli, anemonies, ranunculus, etc., may be started for the early summer bloom, wherever the soil is warm and not too wet. Roses are as nearly dormant as they ever become and may be freely planted, under similar conditions of soil. The same is true of nearly all deciduous shrubs, trees and roots from the nurseries. In Southern California particularly, January planting is rewarded by a good establishment of transplants for thrifty growth and bloom later. In the greenhouse or in the frames both hard and soft wood cuttings can well be started and hard wood cuttings of roses, etc., in the open ground will find fine conditions for rooting.

FEBRUARY.

Viewing California as a whole, February is the greatest month of the year for sowing and planting, which is quite a distinction in a state within whose borders every other month of the year also sees seeds sown and plants set. February is greatest because it lies midway between the beginning of the California springtime in October and the end of the California springtime in May and is, therefore, the average time; it is also greatest because it looks forward to increasing temperature and decreasing rains, while October looks forward to decreasing temperature and increasing rains. The October springtime is for the sowing of hardy plants; the February springtime also favors these and adds to them a host more which need higher heat and a longer duration of it. But even February does not offer complete freedom from frost in all places and so there comes in California a third beginning of spring in May, when the most tender things are safe everywhere except on the high mountains, where each little valley has a springtime of its own, while harvesting is in progress in the greatest valleys below. Such is the infinite variety of California.

In view of these facts how difficult it is, as has been previously suggested, to tell all Californians what to do in their gardens at a certain date! In February, however, in the average California valley location and in the wide district surrounding San Francisco bay, the lengthening days bring increasing heat to the soil which is also prepared by escape of surplus water, which sometimes falls in January, to welcome the touch of the gardening tools and to bring to quick activity the seeds which are sown. The deciduous fruit trees begin to blossom, the weeds grow riotously; the gardening-fever which is a May epidemic in wintry climates, burns in the veins of the California amateur in February and he is irresistibly impelled to sniff the fragrance of the warm, moist soil and to scatter the seed, although no garden calendar for similar latitude in any other part of the continent advises him to do so.

Whenever, then, the well-drained soil breaks kindly at the invitation of the spading-fork, plunge it in to the crosshead with even motion—digging deeply and by dexterous flips with the points secure the evenly broken surface which delights the eye of the true gardener. Rake lightly and not too finely, for there are heavy rains to come and a degree of coarseness in the surface is a partial escape from undue compacting. Do not clean the ground before spading; litter it rather with manure and with the weeds which are cleaned from the walks. All this vegetable refuse, together with the grass and weeds which are growing on the space itself, should be dug deeply into the soil to increase its humus and to promote richness and friability. Then plant everything except the few things which insist on frost freedom. All the things which on the seedmen's packets are marked "hardy" and "half hardy" are safe in February in California, except in low frosty places in the valleys and on the mountains.

If the pruning of shrubs earlier in the season has been neglected, as is apt to be the case in the amateur's garden, do it now. Cut out the weak old wood and shorten the growth of the previous year to good strong wood buds which will now be swelling. Such a bud on the rose will bring a shoot which will bloom in May.

Take cuttings for new rose bushes now if you have not done it already, for dormant wood will root well and bloom soon after the bush from which it was taken. Put in all common geranium cuttings—even the current growth will root readily. Multiply all common border plants like violets which grow by division of the roots.

February is a good month to do anything in the garden which has been overlooked earlier in the rainy season and nearly everything also from which one can look forward with keen anticipation, for much of the satisfaction of the coming months will depend upon what is well done in February.

If you have not already planted out roses and hardy shrubs from the nurseries do it now. Keep the spring-flowering bulbs growing well with manure and water if the rains are light. Continue planting such bulbs as gladioli, watsonia, etc., and plant seed or trans-plant, the whole list of herbaceous perennials. Start pansies, stocks, etc., in the boxes for later planting out. Continue starting carnations from cuttings and by all means plant out irises, if it has not been undertaken earlier. Watch for plant lice on all plants nearly and dose them with soap sprays or insect powders. An early killing lessens later trouble.

MARCH.

The lion and lamb combination of weather conditions which characterizes the month of March in wintry climates is unknown in California. There is no contest between lengthening days, with more direct sun rays, and northerly blasts and the temperature advances evenly and sometimes

quite rapidly. Only in the valley bottoms, or on the high foothills, where there is too great proximity to lingering snow-fields above, does frost sometimes intrude. March in the field brings lusty growth of native forage plants and wild flowers; the roadsides become ribbons of verdure embroidered with golden poppies, blue lupins, yellow primroses, scarlet Indian plumes and a host of others, while the fallow plains are expanses of floral carpets. Nature thus advises the gardener of the season's advance and exhorts him to haste in preparations for summer growth.

March is the dilatory man's opportunity to atone for past neglect. Late as it is in the growing season, he can still dig and rake, sow and plant, and secure a portion of the greater reward which earlier work would have produced. Even sweet peas, which should have been planted the preceding autumn, will make a grand midsummer display from March planting, if kept from thirst by such treatment as will be prescribed in following months. The same is true of all the hardy and half-hardy flowers and even ornamental shrubs, trees, etc., if you can get plants which have not awakened from their winter dormancy. Nursery men sometimes favor dilatory planters by keeping such plants dormant for late sales, so that one may plant out young trees, lilac bushes, and so forth, while older trees near by may be in or even beyond their bloom. California, by the length of its planting season, is the place where the early planter can gain more and the late planter save more, than in any country of sharply defined seasonal changes.

March is a good month, however, for taking the very tender things by the forelock. Under a glass sash and even without bottom heat, seeds of such sensitive growths can be sown to secure plants for setting in the open when they are safe in the frosty places. Thus plants of balsams and other tender flowers can be brought along strongly and safely with the slight heat and the protection from frost which the cold frame affords. A brave show of the hardier summer blooming bulbs can also be had from March planting, though the tenderer ones can wait for April. Gladioli do splendidly.

Although March is a good month for a late beginning, it should not be forgotten that the dry season is approaching rapidly and that all tillage should now be finer and closer than earlier in the season. Fine pulverization of the surface is the blanket which covers the moister soil below from too free contact with the thirsty air. Sometimes heat, almost like that of midsummer, makes a preliminary visit to the garden and gives succulent things a setback which they can withstand if deep drying is prevented by tillage. Sometimes March is almost like May, with its flowers, but lightly touched by showers which give but little to the soil. Therefore, begin in March, if it is dry, the frequent stirring of the surface soil around the plants and give unoccupied places, which are reserved for later planting of tender things, a good surface working also. Do not let weeds grow any-

where in March; it is too late to use them by digging under and every weed is robbing the soil of moisture. Therefore, even if you have to begin in March with the garden, try your best by diligence and activity to atone for the delay—otherwise a start in March will be disappointing.

Seed of pansies, asters, stocks, cosmos can be sown in open ground if the grower has not learned the advantage of earlier box-work under glass or cloth. Pansy plants from the boxes should be set out in blooming places and mulched well. Sweet peas should be given supports if one wishes great quantities of straight-stemmed flowers. Rooted carnations should go into the open ground and more cuttings still put in for later blooms. New violets can be made from runners or by dividing clumps. Bulbs which have bloomed in pots for house decoration will be ready to be transferred to open ground to make good foliage and thus allow the bulb to recuperate. This should be done as soon as the freshness of the bloom passes. Freesias and some other bulbs are helped by removing spent flower stems to prevent seed formation.

APRIL.

April is the month of most riotous growth in the California garden. The increasing heat causes the plants to drink deeply of the abundant moisture which the soil retains from the generous rainfall of the preceding months and the few April showers help also to bring April flowers—for the California April showers need not wait for May temperatures as in the east. The raindrops glisten upon the rose petals and upon the pansies, which bloom freely now from seed sown last autumn, while tulips and other cup-shaped blooms may overflow with accumulations from warm rains. But April showers are sometimes very light and sometimes absent, and the newcomer is surprised at the speed with which his flowers, vegetables and early fruits advance in the clear warm sunshine. As early as April in California there "come perfect days"—balmy and ecstatic to the senses and effective in the garden for pushing forward plants whose rooting has been deeply made from earlier planting. But an April start in the garden, though it may seem very early from an eastern point of view, is very late in California and may be disappointing with many things usually grown from seed, and the newcomer is apt to lay upon the climate the blame which belongs to his own delay. In California gardening an early start is half the battle.

And yet April is one of the greatest of the planting months, because even the tenderest things are safe, except in exceptionally frosty places, and because it is the planting time for midsummer blooming bulbs, tubers and roots. Dahlias, tube-roses, tuberous-rooted begonias, tigridias, and others should be taken from their dry, cool storage places and well set in the warm, moist soil. Seedlings of balsams, cosmos, asters, centaureas, nasturtiums, poppies and the rest of the blooming host, should be removed

from frames and seed-boxes to the open ground. Planting out of hardy perennials, carnations, asters, etc., can also be continued for the sake of succession, with good results, if particularly well cared for with the hoe to guard against drying-out, or if brought along by irrigation. April is also a great month for subdivision of roots of herbaceous perennials, which grow in clumps; callas, fleur-de-lis, agapanthus, calladiums, water lilies, and many others. It is time to begin chrysanthemum planting for fall bloom, and the best of the new shoots broken from the old roots will make good plants in open air garden practice, though later starting from soft cuttings is usually preferred by florists. All sorts of border plants, like the new growth of violets, and so forth, do better if transplanted now than later.

But there is harvesting as well as planting in April. The rose should be relieved of excess of blooming shoots, the strongest chosen to remain, and freed from excess of buds if fine large flowers are desired. Carnation stems should also have side blooms pinched away for the same result. In plant protection there is also much to do, for nearly the whole host of pests, both insects and fungi, respond to benign beckoning to the delight of life in April, and the beginner should haste for expert advice as to destructive measures.

The lawn must not be neglected in the rush of April duties. Too many entrust the grass to the kindness of nature because it looks fairly well, and expect to rush to its assistance after other things are finished. It is a mistake. Good care of the lawn in April will bring much pleasure with it later. Cut out, pull out, rake out, for each weed has its own best treatment, all the foreign growth which the winter conditions have encouraged, so that the freshly starting grass may have air and space to weave its velvety mat. Cut frequently, apply commercial fertilizer and sprinkle, if the showers be few, and thus secure a fine spring condition of the turf as a foundation of summer satisfaction.

It is still possible to put out summer flowering bulbs if they have been kept dormant. Iris should be allowed to dry gradually after blooming. Early planted gladioli and watsonias should be well watered and manured as they will be shooting early flower stems. Scale insects on house plants should be diligently watched for and removed, and in the open the whole army of leaf-eaters will be getting busy, and the garden pump or atomizer should be always ready.

MAY.

May gathers the last of the exposed places into the frost-free period which the thermal situations entered weeks and months before, consequently, thought of protection may be abandoned and the tenderest plants brought into the open air everywhere, except perhaps in the high mountain valleys below the snow peaks. All seeds can still be sown for succession of bloom or of esculent parts and thus is the reputation for California for

continuous beauty and year-around freshness of vegetables, justified. But May work in the garden should proceed with different motive and method from those of the many rainfall months preceding. The secrets of success are: Conserving the moisture from the winter and spring rainfall and the judicious addition of moisture by irrigation. Seed should be placed deeper in the earth because the immediate surface must be kept loose and fine, and will, therefore, become dry and inert, while the roots extend in a moist lower layer. The finely-pulverized dry surface protects this moist layer from the thirsty air; therefore, plant low and keep the upper earth free from roots by the constant action of the hoe and rake. The newcomer from the land of summer rains must learn a new handling of old tools during his first May in the California garden—stirring the soil deeply and preventing crusting at or near the surface. It is not enough to cut or scrape away the weeds with a flat motion of the hoe; the blade should be sent down three or four inches with a strong stroke and the surface deeply loosened and pulverized.

May is the planting month for tender plants and for summer blooming bulbs in places where April is too wet or frosty. It is also a planting month of considerable importance near the coast, because a summer of less heat and greater ærial moisture favors planting later than in the interior valleys. It is not that there is less advantage in early work near the coast, but that late planting is less apt to be disappointing. Therefore, as one takes up winter and spring flowering bulbs when their foilage dies, the vacant places can be covered with late sown annuals or better still, by planting out seedlings already stockily grown in the cold frame or open-air seed bed. The beginner usually has much to learn of the advantage in transplanting such seedlings compared with the growth from seed in place. The garden continuously well filled with varied summer and autumn bloom is the reward of the one who always has seedlings in reserve for transplanting.

May is the month to learn the value of the mulch, and then one will practice it all the year. The clippings from the lawn furnish a continuous supply of mulch; make a thick carpet of it around all newly transplanted seedlings. It protects the soil from the thirsty air and it lowers the temperature a little—reducing to a minimum the shock of transplanting. It also promotes the growth from late sown seeds which might perish from lack of moisture just after germination. The more frequently the lawn is cut the better are the clippings for a mulch. Not only do they have the summer use described, but in the rainy season they cushion the stroke of the heavy rain drops and protect the surface from crusting.

May is the starting time for the gorgeous autumn display of chrysanthemums. Start the plants from cuttings of the vigorous spring shoots from the old stock. Cut loose entirely from the old roots

and trust the soft tissue to make better new ones for itself. Some growers do best with tip cuttings—the top six or eight inches of the new shoot planted two thirds of its length in the ground, but the lower parts of the stems also do well. For grand color effects in the California open-air garden all through the autumn and early winter, the chrysanthemum has no rival.

Pinch the early bloom-shoots out of new carnation plants; it will cause them to grow more stocky for later bloom.

Start new plants of herbaceous annuals and perennials for fall blooming. Seed sown so late in the open ground should be lightly covered with litter to keep the soil-surface moist.

Dahlia tubers may be planted out for early fall bloom.

Vines should be watched and undesirable shoots shortened or pinched out.

Smilax should be shooting new growth. Cut away all the old growth, cover the roots with a dressing of well rotted manure, water well and string up the new growth before it gets tangled badly.

Keep the sweet peas from making pods if you desire continuous bloom. Mulch the surface to keep the roots in moist soil and water well. Drench the foliage well to keep down red spider. Keep the spent pansies picked and prevent seed-formation.

House plants should be watched against drying out for summer evaporation is beginning.

See that the whitewash is in good shape on the green house and frame sashes.

JUNE.

The chief June task of the novice in California gardening is to get wisdom about the use of water. The long, dry season lights its torch even amid the brilliance of the early summer bloom and will scorch the blossoms and sere the lawn almost before the gardener is assured of its approach. To prolong the early bloom and to maintain thrift in the late-blooming plants, June work must be earnestly pursued. Its first essential is to maintain vigorously the deep and fine tilth of the surface soil which was enjoined for May; the second is to use water wisely.

Two things rule in the garden use of water; quantity and method of application—and they rule jointly; neither can displace the other without reducing desirable effects. The whole truth about it would require a treatise, but a few hints may be helpful. The safest thing to do first is to knock a hole in the bottom of the eastern watering-pot: it will look just as well that way in a picture and that is about the only use for it in California. Let the watering-pot perish because it produces an impression of wetness without the substance thereof. The

arm aches with an assurance of much water, the surface of the soil responds with muddy declaration of the same thing, and the plant gives the lie to both vain shows by spindling and yellowing to its death. There is in fact too little water applied and it is applied in the worst possible way and it results in a puddling of the surface, which, by repeated action, deepens until the soil-mass around and beneath the plant becomes a slab of baked soil from which moisture flies away by evaporation and into which after a time neither moisture nor air can penetrate, nor roots extend. The watering-pot has killed the plant—therefore, knock a hole in the bottom of it.

Two things well used will bring escape from the evil just indicated: the garden hose and the garden ditch. For seedlings, or other small plants, in borders and for the lawn, the garden hose with a fine nozzle is the proper medium to convey water, providing the water is spread in a gentle shower of fine drops and continued long enough to penetrate deeply in imitation of a gentle rainfall. But even so good a friend as the garden hose may be taught deceit. Rush into the garden with it, turn on full pressure, dance about with a squirt here and there and then rush back into the house to dress for dinner with the virtuous exclamation that you have "hosed down" the garden—and you have done as little for the yearning plants as would a sprinkle of baptism for a man perishing of thirst in the desert.

The quantity of water must be adequate for deep penetration: the method must be that which carries this water to the roots with the least loss by evaporation, and the least puddling of the soil following such application. Obviously the secret of garden irrigation is the use of as much water as the soil can hold without actual saturation and recourse to watering at as long intervals as is possible without its drying out. The daily hosing may be cleanly and refreshing in a dusty locality, and worth the trouble from that point of view, but it is not a satisfactory irrigation to secure thrifty growth of plants. One good soaking a week or a fortnight, according to the hold which the soil has on water and the thirst of the air to remove it, is incomparably better than the frivolous flirting of the hose which most amateurs are apt to indulge in.

For this reason the ditch along the bed or border from plant to plant, and the freshly made basin around isolated trees and shrubs. with a small stream of water running in the ditch, and the basins filled from the ditch or from the open hose, are ways of garden irrigation which should be employed as widely as possible except for the lawn. The true method for the lawn is to allow the hose or revolving sprinkler to stand in one place until the ground is thoroughly soft and wet to a foot or more in depth.

But there are other things to do in June. Keep the walks scrupulously clean. Remove the spent bloom-shoots of all plants down to the

offer of a good growth bud below. Pinch back the new growth of chrysanthemums, so as to get a very stalwart shoot and remove surplus suckers to concentrate growth in the stalks you select to survive. Train the new growth of all vines to prevent too great freedom and ranginess of growth—and then sit in the shade for long, quiet hours of gladness that the June heat of California has nothing in it of the depression which is born of the mugginess of summer in the humid climate of other lands. Layers of Wistaria, root readily in June, so lay down some while you are resting.

Chrysanthemum cuttings can still be started for later fall blooming. Early started plants should be freed from surplus shoots. Annuals and perennials can be started from seed with increasing care as to protection of seed by mulching lightly. Shady places can be chosen for such late sowing and the result will be much fall and winter bloom of good plants for spring blooming. Dahlia planting should continue for later bloom.

JULY.

The chief activities of July in the California garden are in the line of maintenance. To continue the freshness of the lawn by frequent cutting and ample watering and thus secure verdure around the habitation in contrast with sere fields and hillsides beyond, is held by some as too exacting both of work and water and by others as generous in its compensation for both. The writer's sympathy is with the latter view, but if others choose the former let them see to it that the dry garden does not offend the sight by neglect and untidiness. Remove the trash of early-blooming annuals and bulbs and scrape the ground clean of all perishing grass and weeds. Keep the ground around trees and shrubs well loosened and all intervening spaces well swept, so that cleanliness, which is next to grassiness, may prevail in the July garden.

But July work has other motives in maintenance. All plants chosen for late summer and fall bloom need generous help in July or they will be disappointing; therefore, cosmos and its contemporaries must not be neglected, but must be pushed in growth and well supported to escape accident. With such aid they may be allowed to become great and floriferous, as heat and moisture favor, and a sight to behold. The same will be true of the chrysanthemums if they are well fed and watered in July and kept from distributing their strength through too many stems and flower buds. There is, therefore, much to do in midsummer in the California garden though new plantings are few.

The rose garden should receive careful attention. Bushes which are kept in constant growth by proximity to lawns or in regularly watered borders should be progressively pruned, cutting back shoots which

have bloomed, to good new laterals below that they may be pushed to greater development and an excess of shoots should be reduced—saving always the best of them. Roses too often become brushy and unthrifty from neglect of summer treatment. But the best rose garden is one which is not pushed into constant activity. Bushes which have done well in the spring and matured their new wood by midsummer are entitled to a rest and though we cannot know whether they actually feel fatigue or not, we do know that to get the best fall bloom, the bushes should be credited with weariness and allowed to rest in July. For this reason it is best that the soil should be allowed to dry somewhat and, as the leaves show the maturing phases, the bushes should be pruned, shortening the shoots and reducing them greatly in number, so that the reawakening activity of autumn may find fewer outlets for its impulses. This summer pruning of roses, when grown away from plants which must be kept active, adds greatly to the summer aspect of the garden, because the rose section is clean and orderly though at rest, while a sleepy rose bush amid riotous summer growing plants offends the eye. Beyond this, however, is the greater reason for the treatment and that is the anticipation of late fall bloom. Many roses are better in the autumn than in the spring and nearly all respond gloriously to the call of moisture after a mid-summer dormancy and in the delightful November days bring a grandeur to the California garden which, in the nature of things, those who live in wintry climates cannot know.

Though July is chiefly a maintenance month, it should be used also for starting plants from seed for next winter and spring blooming. The covered cold frame or lath sheltered or well white-washed greenhouse can be used to good advantage and hosts of plants grown for fall planting out.

Freesias are restless bulbs and should be given a July planting for their earliest blooming.

AUGUST.

August is the time to prepare for the second California springtime which the beginning of the rainy season ushers in. The character of the preparation depends upon the location and also upon the moisture available. The irrigated garden has possibilities far beyond those of the rainfall garden; therefore, if you have water, clear away the debris of the summer crop, soak the soil deeply and, as soon as the soil works well, fork it over thoroughly, fine the surface and sow all kinds of annual flowers which you desire. Many tender things can also be sown in August if you have a location free enough from fall frosts to allow them time to mature. In the hottest interior situations, however, August sowing does not succeed so well as near the coast because some seedlings cannot endure the dry heat even if soil moisture be adequate.

On a small scale a lath or cloth shade may protect them without too great outlay. It is interesting to try many other things with an August start on irrigated land, and a beginner will often be surprised and delighted over his achievements if he dares to defy the warning of the wiseacres who tell him he must wait for the fall rains.

Even for the rainfall garden there is much which can be begun in August. Of course, actual work in the open must be deferred until the soil is deeply moistened by the rain, but a corner of the garden, partially shaded from the sun, can be moistened from the well or house pipes and made into a seed bed, in which hosts of things can be grown closely together to be ready for transplanting to the open when the rain comes and one can get a start in this way which will compare well with the advantage of winter growth of seedlings for spring transplanting. Let the beginner remember that California has two springtime changes: one from cold to warmth and the other from drought to moisture, with continuation of the same warmth, and he can get a better idea of the capabilities of the California garden and work better to realize them.

August has also very important relations to the autumn bloom of shrubs and herbaceous plants which flower through a long period. The chrysanthemums must, of course, be encouraged with water and other liquid refreshments which are to their tastes. Dis-budding of the selected shoots must not be neglected and to guard against both sunburn and dust prepare to stretch a cloth canopy over the plants which are grown for single blooms.

Open the trenches along the rows of rose bushes which were put to sleep last month and thoroughly soak the ground, replacing the earth and hoeing the surface well as the water disappears. This moisture, with the ample heat, will soon awaken the roses and they will stretch out long arms of new growth to bathe in the sunshine which is more and more delicious as its July fervor lessens. Generous August treatment is the price of gorgeous Thanksgiving roses.

One more August opportunity looks beyond the fall bloom. Biennials and perennials which bloom the second year in wintry climates count a year in California as good as two years elsewhere, providing they are started so that they can grow in the latter half of one year and bloom in the first half of the next. The list is too long to even name the plants which thus declare their joy in coming to California.

In addition to these common hardy perennials, August is the month to start plants of many favorites of the greenhouse, to be shifted, as they advance, into pots for winter house-bloom, or possibly to be grown in the open air in certain protected places and thus convince the visitor as he looks upon them beneath the palms, araucarias, cycads, lantanas, etc., that the California garden is really a conservatory out of doors.

Freesia planting may be continued and a beginning should be made with other bulbs of fall and winter bloom. Wet and dig the soil deeply and keep reasonably moist until the rains do it for you.

Amaryllids are ready to be helped into bloom with a little water to be increased as the flower stems break through.

Asters need water and liquid manure to show grand flowers, but when these appear, water the roots only to get perfect flowers.

Pansy seed should be sown under cover for several shifts before planting out.

Chrysanthemums must be protected from leaf lice with tobacco tea or tobacco dust thrown into the leaf clusters where they usually first appear. The plants also need staking if they are to be grown for single, heavy blooms.

Cineraria seeds should be sown for winter blooming. Although they require the most careful treatment described for fine seed in the chapters on propagation, the plants volunteer freely when self sown on the garden surface by the old plants. The cineraria in bloom in California winter gives the tourist his keenest appreciation of our "greenhouse in the open air."

Chinese primrose seedlings should be started for winter house-blooms.

SEPTEMBER.

And now comes the second springtime in the California year which has been anticipated in previous monthly comments, and, wonderful to relate, the vernal September exerts opposite influences in the two chief natural divisions of California. These chief divisions are not north and south, for latitude has little to do with climate in California: they are coast and interior valley and topography is the divisor. The interior valley regions, which extend disconnectedly from Imperial to the head of the Sacramento valley through about five hundred miles of distance, become cooler as the shortening days, less direct rays, and fleeting cloud-veils reduce solar fervor.

The coast regions, through a similar distance, become warmer as the westerly winds of midsummer cease to spread ocean temperatures and fogs over the coast slopes and valleys which lie in clear sunshine westward of, and among the ridges of the Coast range. Thus the September springtime cools one great district and warms another, and brings both into better condition for growth of plants which will quickly attain usefulness or beauty before the winter frosts, or are by their nature so little affected by them that they can mature in the following winter or later. And it is not only the September heat which has a vernal character: the early rains often bring a delicious moisture to the air, which delights the garden and the gardener.

Let September, therefore, be a month of great activity in California gardens, except at altitudes where wintry conditions prevail, and where autumn is a time of ending rather than of beginning. In places where early rains are very light, clear up and burn the rubbish which will not easily decay, spread the scrapings of the cowyard and poultry-yard, start the whirling sprinkler, or adjust the hose nozzle, and allow an artificial rain to fall for an hour or two until the ground is soaked deeply, or produce the same effect by flood or furrow with water from the irrigation ditch. Soon after, fork in deeply the fertilizing cover, break the clods, even the surface but do not rake finely, except where the sowing of small seeds requires it. Leave the surface, rather, like a carpet of walnuts, so that rain can fall without crusting the earth. The purpose of work in the September springtime is to open the soil to receive the rains: the purpose of the March springtime is to close the soil against evaporation.

In ordinary coast and valley situations sow in September, upon soil moistened either as described by irrigation or by early rains, seeds of all flowers which you delight in, except the very tender ones.

Hardy flowers will do as well for late fall and winter bloom and will make the California garden gay all through the darker months. Such slowly developing plants as pansies and sweet peas, and a host like them, too many to mention, are really not at their best unless they get an early autumn start. They need time for deep rooting and strong stem and foliage development, and the autumn springtime is the time to begin with them. It is also the season for planting winter and spring flowering bulbs—the glorious narcissus family, hyacinths, tulips, in fact, the whole bunch which is called "Dutch" and many others.

Do not get slack in maintenance work. Forget the eastern feeling that the year is closing, and do not acquire the old California feeling that the rains that are coming are to be listlessly awaited. Do not stop sprinkling the lawn because it happens to be a calendar month for rains. Keep ahead of the rains: keep getting ready for the rains, but never wait for them. The California autumn in a well-kept garden is a continuous Indian summer, with all the colors of eastern summer added to the brown and gold of eastern autumn.

Bloom buds should be selected on chrysanthemums and all others pinched off—if you are working for large singles. If not it is desirable to remove a good part of the buds. The plants now need generous treatment including liquid manure and some sort of a sun and dust shade is necessary for finest blooms. Keep pushing the chrysanthemums. Mulch with good manure and water, or let the rain fall, upon it. Be generous with all holiday-blooming plants. They should not be allowed to feel the pinch of drouth.

Water the roses freely if the rains are not ample: it is the price of rich fall and early winter bloom. If the roses were not pruned last month, do it now.

All old stems of summer blooming plants should be removed and the new growth from the root given a clear start. The wreck of annuals, from which nothing more is expected, should also be cleared away—if it has not been done, as each plant passed its zenith, which is the better way.

It is seasonable to plant tree seeds where moisture is assured and temperature promises to be favorable.

If the situation is warm plant anemonies, ranunculus and gladiolus of the small-blooming class which flower early. Watsonias should also be planted in favorable places.

Annuals and perennials previously started in boxes should be planted in open ground if the soil is moist and warm.

Subdivide irises and replant for better bloom than that of old clumps.

OCTOBER.

October is a continuation of the autumn planting season and is much like September, except that light and heat are slightly less and light frosts are nearer. Consequently, in places where fall frosts are expected the interval may be too short for tender plants to advance from seed to service. But plants which must be rated as tender are few in California and with these in strictly frostless situations, and with all the multitude of others in places of medium elevation, the month, which is counted late in the fall at the east, is early in the growing season in California. In fact, generally in the valeys and on the mesas, October is one of the best planting months of the year, although many are too slow to realize it and fail of the best results with sweet peas, pansies and many other flowers because they try to follow eastern seed catalogues and eastern garden literature. California is different from the rest of the country and October work in the garden affords one of the most striking demonstrations of this fact.

The early rains have fallen. The soil, even of the most neglected garden, is mellow and fragrant and full of the microbes of the garden fever which entered the blood of mankind when Adam first poked a sharp stick into the leaf mold of Eden. Neither immunity nor attenuation has resulted from thousands of generations of inoculation; on the contrary susceptibility and virulence heighten with advance of civilization and are now relieved only by deep thrusts of gleaming steel, while pothering with a stick satisfied Adam. The more delicious the weather, the more friable the earth, the more winning the call to growth which appeals to all human senses, the higher runs the gardening fervor. In this respect October is the eastern May and in some seasons even deciduous fruit trees are deceived by it and burst into bloom. Could there be clearer declaration of vernal conditions in the California autumn?

Those who have waited for the rains may now enter quickly upon the operations presented a month ago for the irrigated garden. It is the best time of the year for soil enrichment with the ordinary materials, because the ample moisture will induce their speedy decay and assimilation. Make generous application in October so that the rains may carry the soluble richness down to the roots and leave the coarser parts to make mellower the surface soil which may be worn and wearied by tillage.

Begin in October the pruning of deciduous shrubs and trees. In gardens they need constant training and trimming to preserve shape and increase vigor and to enable them to answer the requirements of the artificial life you must teach them, to attain your purposes. You need not wait until the leaves fall; when they become limp and lose their natural pose their work is practically done for the season. You can finish the pruning and clear up the debris from the firm ground before the fall spading and escape compacting the loose earth by tramping over it to do winter pruning.

Continue planting bulbs for winter and spring blooming. Dig up and replant singly such bulbs when they have become massed in too large clumps, else they will pinch each other into inferiority. Fertilize the borders where the rains will awaken the violets to new growth and keep the fall-blooming roses and chrysanthemums well fed and watered, so that your garden will be glorious at Thanksgiving. Keep the lawns and walks clean of falling leaves, but do not burn anything which can be dug into the soils of the borders. Leaf mold is naturally scant in California, therefore, husband carefully the contributions which the plants make for their future thrift. Keep the old lawns well clipped and start new ones. Be active in garden effort; a little over-exertion is never so safe as during delicious October days, which have neither chill nor burning.

Scatter seeds of California poppy and the whole range of native wild flowers. The rains will start them. It is nature's way.

Continue dis-budding and care and watering of chrysanthemums if rains are slack—not forgetting cloth shelters from too hot sun and too free dust if rains are late. Fall fogs will dust bedraggle the blooms.

It is still time to prune roses which have been allowed to carry their summer growth of brush so late.

Continue sowing sweet peas, deeply in light soil, and finish sowing of stocks, pansies, etc., for late winter blooming. Marigolds will also give you warm winter color-masses.

Japanese iris should be planted and penstemons will give late fall and winter bloom.

Plant out seedlings of annuals and perennials still standing in seed beds or boxes. Pansies, stocks and the whole throng of their associates will bloom for the holidays if now set in places of warm autumn

sunshine. It is also time to plant seeds for succession—so long is our fall-growing season. For those who prefer sowing in open ground without transplanting, the season is also right in coast or valley districts.

Give the lawn a good cover of well-rotted and finely-broken manure —if not already attended to.

Cineraria seedlings should be set in shaded places, also for winter and spring glory of long duration. Delphiniums, if they are dormant and not indulging in fall bloom, can be re-set if more plants are desired.

NOVEMBER.

If the suggestions for the last few months have been heeded, the Thanksgiving month will find the California garden gay with colors and rich in foliage forms, and the Thanksgiving table decorations may be blossoms fresh from the open air, commingling their fragrance with the incense of the eucalyptus fagots which blaze brightly on the hearth. Many think Thanksgiving reunions lack an important element unless fire burns as a token of the warmth of family affection. In California another token is added—the beauty of the flowers manifesting the warmth of the mid-day sun and declaring the thankful spirit, both in man and his environment.

Autumn roses and chrysanthemums are in their fullest glory—it is their harvest time. It is the grower's delight to admire them; it is his duty to judge them discriminatingly. Those roses which are best in the lessened heat of autumn should be noted, and the thriftiest bushes marked as a source of cuttings to be taken later. Roses should be thus judged at least twice in the year. Chrysanthemums are judged once for all, but be sure to drive a stake, which cannot be displaced by spading, beside the plants which it is desired to remember when spring growth is taken for cuttings. The same exhortation, to mark the best and not trust to memory, is made for all the splendid bloomers; the carnations, cannas, dahlias, pelargoniums, geraniums and many others which contribute to the glory of the November garden. Except where spading, fertilizing and lawn-making have been delayed to await the rains, November garden activity largely consists of enjoying, planning and resolving for the future. It is rather too late for fall sowing where frosts and heavy rains are to be expected, although there are many thermal situations where even the shortest days bring conditions favoring deep rooting of seedlings or bulbs for mid-winter and spring maturity.

November is the beginning of the transplanting season for deciduous trees and shrubs, and, when the ground is deeply moistened by rain or irrigation, this early transplanting is particularly desirable in the drier and warmer parts of the state. The transplanted tree soon

begins to establish itself with new rootlets, if the ground is warm and moist, and is, therefore, better fitted to sustain the leaves which sunshine on twig and branch calls forth. But November is only the beginning of the planting season, and in some localities later work is more desirable.

November is a month for great activity in bulb planting which has been delayed, also for open-ground sowing of the multitude of native and introduced plants which make winter growth and early spring bloom. It is also timely to set out bedding plants, brought along in pots or boxes from earlier sowings. They will bloom even into midsummer.

Sweet peas now planted will continue late winter bloom into spring time.

Freesias, held back from early planting, will now go forward into a good later blooming season. Watsonias also will do well if not longer delayed. It is also still time to plant irises.

Dahlias, gladioli and cannas should now be taken up and stored in a dry, cool place for planting out after the cold rains are passed: although they will survive being left in place, better flowers come from keeping them out of long dormancy in cold, wet ground.

DECEMBER.

Shorter days and lower temperatures bring the California garden to its nearest approach to wintry conditions during December; but autumn flowers still bloom, fresh grass grows and trees put forth new leaves in many parts of the state. It is not uncommon to see the same kind of flowers amid Easter, Thanksgiving and Christmas decorations.

And yet there is work to do in December which is, to a degree at least, distinctive. Deciduous trees and shrubs are nearest to dormancy and, therefore, in good condition for pruning and for propagation by hard wood cuttings. Roses, which were encouraged to autumn bloom by the treatment prescribed last July and August, are now entering upon their longer rest, and may be thoroughly handled for shape and for the growth of new wood. Thrust sharp shears, then, into the brushy bushes and cut out, close to the roots, old wood which has done its work and save enough of the younger stems to renew bush-form, selecting both for strength and position, so that new shoots, soon to come, shall have space to develop and contribute to symmetry. To the skillful pruner a well-rpuned bush has a peculiar beauty, because it suggests future shapeliness and vigor, while to the uninitiated it may be but an ugly bunch of prongs and stubs. Try to realize this and you will find a deeper significance in pruning and learn how to do it rationally. Standard shrubs and fruit trees are, in a way, treated

differently from those in bushform, but the principles of preserving symmetry, renewing wood for vigor and spacing for opportunity are still to be applied. The bright December days, sharp tools and keen interest make pruning study and practice particularly delightful.

Cuttings of roses and other hard wood which roots readily, can be taken in any quantity from the prunings. Well-matured shoots of medium size, straight and clean, in six to eight-inch lengths (rejecting the softer wood of the tips) make quick rooting if buried two-thirds of their length in moist, well-drained loam. Cuttings of hardy, soft growth, like geraniums or pansies, also find adequate heat in December, although the tenderer herbaceous plants will do better later. Transplanting of deciduous trees, shrubs, vines, etc., is also timely and orders to nurserymen should not be delayed. All this can be done later, it is true, because California has nearly half the year for planting deciduous growths, but you can often get better plants by early orders and better results by early planting.

Continue planting seeds of hardy flowers; though top growth may be slow the roots will establish themselves. If your land lies low and is liable to fill with water, dig or plow up ridges and plant upon their crests. Keep thinking and inventing to secure slight shelter, to avoid excess of water and to corner the slanting sun rays and you will surprise yourself with your December achievements.

The December garden need not be bare, though it too often is, even in California. Violets, started into new life by September rain or irrigation, will fill the air with fragrance. Hardy bulbs, like narcissus and others, freely open their cups and tubes to catch the raindrops. The geraniums are gorgeous. Roses and chrysanthemums still linger—in fact, an innumerable host of blooms may cover the garden, if the planter plans for them. The brilliant red of the toyon, or California holly berries, in their evergreen setting, will always be our formal Christmas decorations, but the California home garden will fill the vases or shower the damask of the Christmas dinner table with many hues and forms of beauty, without recourse to the conservatory, if one but gardens wisely and devotedly.

It is still possible to catch up with fall-bulb planting and may even be desirable to plant late if moisture has been delayed, for these bulbs delight in moist air and soil, which, fortunately, are normally earlier in beginning. Still one will get gladness from late planted bulbs for our usual frosts do not vex their growth.

Seed planting of herbaceous annuals and perennials may also continue, if there is not too much cold water in the soil.

Preparation is timely for planting out dormant roots of perennials or growing plants thereof, in the warmer parts of the state. Good, deep spading or forking of spaces for such planting should be done and well rotted manure freely mixed in during working the soil.

If ample rains have come, the spent fertilizer should be raked from the lawn and regular cutting resumed. There is great temptation to neglect this and to cause the lawn to show a crazy quilt of greens and yellows after a cutting which has been delayed too long. This is unnecessary in places where there is no hard or prolonged freezing, as will be explained in the chapter on lawn making.

PART IV: CALIFORNIA'S WAYS WITH GARDEN PLANTS.

CHAPTER XIII.

LAWNS AND GROUND COVERS.

The "open spaces," stipulated for in Chapter V, should, if possible, be covered with flat verdure. They should be lawns, for which we accept the common definition, "pieces of grass or clover kept closely mown" or the semblance of a lawn produced by other plants which for distinction, will be designated in this connection as "ground-covers." Of course there may be reasons in individual instances why neither of these can be undertaken or must be deferred and then the owner must be content with a winter-lawn of native plants and, in parts of the state with generous rainfall, they will give verdure for a third or even half the year and rich yellow and brown hues during the remaining fraction of it. Many people honestly prefer this reproduction of the natural California landscape and it must be conceded to be commendable, but the proper enjoyment of it implies certain duties which are apt to be overlooked.

Winter Lawns of Native Plants.—If one feels the impulse to be content with rainfall-verdure on the ground of its natural beauty and accepts the summer yellows and browns as a very desirable substitute for the bleak whiteness of a snow-cover which must be endured in wintry climates, he should plan open spaces for it just as carefully as he would if he intended to secure lawns of perpetual verdure. He should arrange trees and shrubs in the same way for open spaces, vistas, tree and shrub clumps, etc. He should not try to cover the ground with a crowding of trees and shrubs in the vain attempt to convince the visitor that he likes them so well that he cannot bear to see the bare ground! It is too thin a subterfuge and the visitor will pity him for throwing his house into a thicket, because he dare not face the open spaces.

If then you really prefer the natural colors of the California landscape in your garden, demonstrate the fact by laying off the ground to really get the advantages of them. Afterwards treat these spaces in a true garden-like way by giving the ground a good even surface, flat or sloping as the land may be. Then add to its resources by scattering seed of the annuals which contribute to the richness of both winter verdure and summer browns, such as burr clover, alfileria, etc., and go over it occasionally with a hoe and cut out the tall, rank weeds before they have a chance to ripen seed. It will also prolong the verdure and add to the beauty of the areas, if the growth is cut oc-

casionally with scythe or mower during the growing season: or it may be pastured lightly when the ground is firm, by roping old Brindle or Dobbin on it. The effect will also be heightened both summer and winter by an occasional manuring. When the growth has matured and you have sufficiently enjoyed the aspen-like effect of the quivering seed stems and all that, run a roller over it to crush down the dry growth or go over it with a mower, if you prefer, and gather up the dry stuff with a horse rake. This will rattle out the ripe seed and gather up enough of the coarse stuff to preclude danger of summer fires. Then you can enjoy the yellows and browns of your trim summer lawn and be sure your trap is duly set for a good display of autumn verdure, if the rains are early, and of winter verdure, if they are delayed. If one will do these things he is justified in the claim that he prefers the natural summer hues: if he does not do them, he is not gardening at all, but shirking the work which is essential to the full enjoyment of what he claims to admire. Meantime he must keep wide cultivated borders between his unstirred, unwatered spaces and his trees and shrubs or they will not hold the verdure which is needed for the contrast between greens and browns, which is usually a part of the philosophy of our advocates of natural lawns and their environment.

The Superiority of Verdure.—There is however in the mind of the writer no question of the superiority of perpetual verdure on the open spaces of the garden. He can get all the browns and yellows he needs either from the wallflowers and other cultivated bloom, or he can find it covering the vast expanses of wild pastures or of grain fields which are not wholly banished from the surroundings of even our most highly developed horticultural districts. Therefore his exhortation must be to provide a lawn, or the semblance thereof, for the open spaces immediately enclosing the home—no matter what the adjacent fields may carry as commercial crops.

And the writer will proceed further, even to this horrible horticultural heterodoxy—that a rather poor lawn is better than none. He has never had what, by professional standards, could be called a good lawn. His lawns have always been of the character which requires observation from the west at sunrise and from the east at sunset. They never could endure being looked at from above. And yet they have always been beautiful in perspective and have afforded a carpet of verdure able to carry the eye from point to point, among the higher growths around the open spaces, quite acceptably. But a lawn must, of course, not be unreasonably bad. Good gardening could have nothing to do with such a one but good gardening can make a reasonably bad one respectable. Considerably less than the ideal amount of water and fertilizer will keep the grass green even if it is not able

to thicken into a very good turf, but it must not be stinted in work. Close, even cutting with a sharp mower, good raking, when desirable, neat trimming of edges and weed-cutting or pulling, as may be required and general cleanliness of the grass-spaces—these must not be neglected.

And then if one really dare not undertake a lawn for any reason of trouble or expense, he may still get continual verdure on his open spaces by recourse to the ground-covering plants which will be mentioned later in this chapter.

HINTS ON LAWN MAKING.

A plot of land for grass should be first graded sufficiently to remove small hummocks and to fill small hollows in which surplus water may gather. If the plot has hollows too large to be filled to a drainage grade, an under-ground drain of tile should be taken from the low points to a gravity outflow—unless the soil is very open and deep enough to naturally distribute all water likely to come by rainfall or sprinkling so that there shall not be standing water or mud below the surface for that will cause growth of sedges or other coarse stuff which is natural to such conditions.

Preparation For Seeding.—After providing for grade and drainage a heavy coat of well-decomposed manure should be worked in by spading to full reach of the tool. This should be done both on light and heavy soils for the reasons given in Chapter III. Although, if moisture conditions are favorable, you can get a catch of grass in a garden with no more work than is given to sowing a pasture field, you will make your whole future course of experience with that grass plot more gratifying if you do a little harder work at beginning. While spading give particular attention to breaking up clods and chunks of manure by deft use of the spading fork, which the writer has always found better than a flat-bladed spade, because of the pulverizing effect of the tines in punching and striking lumps. Dig for an even surface of course, but do not think you are doing a good job if you are simply spreading it over a lot of clods and air-spaces. It is not desirable to pulverize the surface too finely unless you are doing a hurry up job late in the season or in a dry time and are more fearful of the moisture you have than of anything else.

When to Sow?—Taking the state as a whole, except perhaps, the high mountain valleys, the best time to put in a lawn is the early autumn and if you have water to deeply wet the soil in August and have it in the condition described in the last paragraph before the fall rains begin, you will have made a good start. Let the ground lie then for the rains, or if they are deferred, wet the surface by light sprinkling so the early autumn heat may sprout the wild seeds.

Destroy them by raking or let all that will perish in the dry heat, cut out the survivors with a hoe and sprinkle again lightly to start some more seeds and get rid of them. A month or so spent in this way, if you started in August or September, will help greatly to get a clean start of the plant you desire. But if all this preparation seems tiresome, you can proceed to seed the lawn, if the soil is deeply wet by rain or sprinkling, and kill more weeds afterwards. The point is to get moisture enough below to keep the surface from drying too quickly after you put in your seed; also to invite the seedling to root deeply after starting. If, then, you are in the midst of fall showers, it will be easier to get a stand of young grass and to escape crusting of the surface by sprinkling. It should be clearly stated however that though the early autumn moisture season, which is the time when nature starts her seedlings, is best to kill what you desire to escape and to start what you wish to keep, it is perfectly possible to start your lawn at any time of the year except when the soil is too wet to work and its fullness of cold water does not give good conditions for germination. Those who know how to put in lawns will contract to do it successfully for you any day of the year that the soil is in fair condition, if they have water under pressure to substitute sprinkling for rainfall.

Seeding.—After deep digging the preparation for seeding consists in deep raking and you have to learn the knack of raking without dragging the surface into humps and hollows. It is the function of the hand which is nearest to the rake-head to do this while the other hand is doing the pulling and pushing. Learn to carry the chief weight of the rake on this lower hand and you can pulverize to the depth of the tines without shifting the soil except as you desire. In this and in other acts of seeding, tramping the surface should be avoided by working through the center of the plot from light boards. A six-inch fence board, as long as you can get it, is most convenient in shifting.

After having raked the width you can handily reach from the board—trundle the wheel barrow along the board and gather up the trash you have raked out. Then scatter the seed also from the board, for it is easier to get even distribution near by, rake again lightly to cover the seed and go ashore for a wheel-barrow load of finely pulverized old manure which should be dry for ease in pulverizing and in thinly spreading over the surface. If this manure has been treated as described in Chapter V. it carries no live weed seed and will make a nice cover to shade the sprouting seed from the sun and to keep the surface from compacting by heavy rain or frequent sprinkling which will be necessary to start and bring along the grass in a dry time. This way of putting in a lawn in strips, finishing as you go, is

a great saving of effort. About all the beginner has to look out for is raking so that the surface does not look like the waves of the sea but that is avoided by raking expertly, lapping the strips and not trying to get along with strips too wide for good work.

What Kind of Seed?—It is the conviction of the writer that the best textured, best colored and most beautiful of all lawns in California are those of the Kentucky Blue Grass, but such a result is secured at the price of the best skill, the most persistent work and the most abundant watering. His choice for his own place however is a lawn of Kentucky Blue Grass and White or Dutch Clover. The clover shows a green when the Blue grass is disposed to brown a little in frosty weather and thus gives a better winter effect from the mixture than from Blue Grass alone. Besides the White Clover is a quicker space-filler and thickens the carpet sooner but does not prevent the Blue Grass from sufficiently asserting itself later. In fact the two go along well together for years if given even fair treatment. It is possible to get a good stand with a pound of seed to 300 sq. ft. of surface, but it is better to increase the amount to one pound to 200 sq. ft. The seed costs less than disappointment. Where the seeds are sown together, some use equal parts of each, others twice as much Blue Grass as White Clover. It depends upon which you wish to preponderate.

It is possible to get a very satisfactory lawn from White Clover sown alone and some prefer the aspect of the persistently appearing white blossom heads. Our taste is for a clean green-sward such as comes from the mixture for the blue grass keeps the clover from rioting, if frequently cut. On the other hand we greatly like white clover for a laundry yard or a backyard lawn, because it responds very rapidly to less water than Blue Grass requires, and because, owing to the tenderness of its stems, it is quite easily cut with a dull lawn mower, such as the most conscientious amateur is apt occasionally to have.

If you wish to get a lawn very quickly, and one that will maintain a respectable appearance with a little less care and water, Australian Rye grass and white clover sown together will probably give the best results. The Rye grass lawn never has the beauty of the Blue Grass, and yet Rye grass is very widely used in this State, because it will be fair looking with less water and labor. It has, however, the common habit of drouth-resistant grasses, viz., to become bunchy, and its persistence in seeding causes it to make wiry seed stems instead of foliage, and these are exceedingly hard to cut. The amount of seed is the same as already given for the other mixture.

Another grass which comes easily and is used considerably for areas partly shaded by trees, is Orchard grass. Its coarseness and bad habits are those belonging to Rye grass, but, like that grass, it is also easy.

The grass which is surest to catch in a place and surest to hold on is Bermuda grass, but it can hardly be mentioned in a garden connection because it invades all areas not intended for it and is practically impossible to dislodge. And yet Bermuda grass is an exceedingly grateful plant and will give more verdure for less care than any other plant grown for lawn purposes. It is also very tolerant of alkali soils and will grow with little or no watering, even in our hottest, driest places. It does become stemmy and rubbishy, however, and it loses its whole top growth by frost, so that it cannot be depended upon for verdure. In summer, however, it is turfy and cushiony, and one can get much joy from it, if near the close of the frosty season all the rubbish is sharply raked off and burned—for fear of spreading by root or seed. After raking one can shave off the whole surface with a sharp spade and in this way a softer growth will be secured from the roots. A start can be made either from the seed or by tearing up and chopping the roots into small pieces—for every inch or so of the root will make a plant—and raking these root-pieces into the soil. Bermuda grass will grow in all parts of the State except at elevations where there may be monthly frosts or deep ground-freezing in winter. Its usefulness, however, is greatest in the interior valleys. The late Mrs. Sherman of Fresno once said of it: "The center of attraction in the garden is the lawn, and with the despised Bermuda grass anyone can make one—one the babies can roll on, the older children play tag on, and the family all have their rocking chairs out there without fear of spoiling the grass; indeed, this grass rather enjoys being abused, for it gives it a chance to show how it can rise to meet hardship."

Alfalfa can hardly be said to make a lawn, although it does produce verdure which is very grateful to the eye and vegetation acceptable to the cow and the fowls during the dry season, and it can be had with little cost or effort.

WHAT OTHER CALIFORNIANS SAY OF LAWNS.

To broaden this discussion of so important a matter as a California lawn beyond the writer's experience and observation, welcome is given to a few paragraphs which may be helpful to readers:

Why Seed Heavily.—Charles Winsell of Los Angeles argues for plenty of seed in this way: "One pound of grass seed should be used for every 200 square feet. The best lawns in our vicinity are made of Kentucky blue grass and white clover. These should be used in equal proportions. This amount of seed may seem heavy, but there are several reasons for it, as well as mixing the blue grass and clover. Much soil has not been intensively cultivated nor watered until the lawn is made, consequently this

soil is full of weed seeds. It is impossible to make them all germinate at the same time, even though the ground has been thoroughly prepared. The remaining seeds will germinate gradually while the new lawn is in process of growing. If lawn seed is not used in good proportions, or if the seed is of a poor quality, these weed seeds will predominate and get ahead of the lawn seed."

Why Clover With the Blue Grass.—Mr. Winsell also gives reasons for this mixture of seed: "In places which are most exposed to the sun, weak spots will appear in the lawn if it is not watched very carefully. It is only a matter of time when devil grass will appear in such places and soon spread throughout the lawn. To remedy this, the white clover is used in connection with the blue grass. The blue grass is slow to germinate, especially when the nights are cold. In fact, it takes nearly a year to stool out enough to make a good start. The clover will germinate readily in either warm or cool weather. It will shelter the blue grass and crowd out the weeds, and in the meantime the blue grass will be stooling out, leaving no room for devil grass or other undesirable weeds. These conditions prevail around places that are inland. However, the conditions differ as we near the ocean. Clover will stand the ocean breeze much better than blue grass. It will stool out more, and will not grow as rank as the blue grass. Neither does it require the moisture that it does when grown inland."

Poultry Manure for the Lawn.—Poultry manure, if kept in good condition, free of feathers and trash, is better for the lawn than barnyard manure. By removing the poultry droppings daily and keeping them in a covered box or barrel with a layer of dry dust over them, they make the very best fertilizer for lawns, flower beds and kitchen gardens. It is not alone richer than barnyard manure, its elements are more easily utilized, being almost as quick in their action as nitrate of soda, and it is free of the nits and larvae of grubs and flies, while barnyard manure is the habitat of all such.

Sowing Grass Seed With a Sieve.—Sow grass seed with a sieve. The latter can be readily made by taking the bottom out of a small shallow box and tacking a piece of wire window screen in its place. It will always come handy about the garden. After the ground is thickly sown with the grass seed, cover with sandy loam put on with the sieve, then wet down with the sprinkler. Some mellow soil from the chicken yard is good for the covering, as the fowls will have scratched out all seeds and insects. The planted seeds must not be allowed to dry out, and the lawn will need to be sprinkled every evening in dry weather.

Burning Off Weed Seed.—If the plot to be seeded to lawn is overgrown with dry weeds, it is a good plan to burn it over, as this kills many weed seeds and insects, and the residue is excellent fertilizer. In any case, rake up and burn all trash, then wet down and spade the ground, and thus

tempt the dormant roots and seeds to show up. When these have covered the ground, turn them under and allow them to rot. Now spade deeply and mix well with manure, then sprinkle and leave for another showing of weeds, which cut out as fast as they appear. When there is no further growth of weeds, spade and grade or level the plot.

Clover Preparatory to Blue Grass.—An Oakland gardener, whose name is not recorded, gives this advice: "The quickest lawn, the one which is most certain to give good results on almost any ground, and one which is so attractive that many people actually prefer it on its own merits to any variety of grass, is the white clover. Clover, being a legume, instead of depleting the soil, adds nitrogen to it, and brings it into a better and more fertile condition. If you want to have, ultimately, a Kentucky blue grass lawn, which, after all, is, in the general estimation, the ideal lawn, you will do well to plant white clover first, and at the end of a year allow it to grow tall and rank, then dig it up and turn it under as a green manure before planting your Kentucky blue grass. This way you will be pretty sure of a successful blue grass lawn in the end, whereas you may struggle along for a year by other methods and not succeed in getting a good lawn in that time. Sow white clover seed at the rate of one pound to 350 square feet."

Sowing With Sand.—The same writer gives this hint about handling seed: "Buy only the best re-cleaned seed, and in order to sow it evenly, mix it with twice its bulk of clean sand. If you suspect that the sand is the least bit salty, put it in a pail and cover it with water, and pour the water off, two or three times. Sow the sand and clover seed, mixed together, evenly over your plot, standing on boards and moving them along so as not to indent the lawn surface."

The Roller on the Lawn.—The desirability of using a roller in lawn work depends largely upon the character of the soil, and afterwards of the turf which is secured. As a rule the roller is an implement for light sandy soils and not for heavy soils, which are apt to become too compact by action of water, without rolling. Therefore this advice has to be discriminatingly read: "Scratch the seed mixture in lightly with a steel rake, taking care not to pull the seed up into patches; then roll with a light roller. Patting with the flat of a spade is a poor substitute for rolling, and it is impossible to have a perfectly smooth, even lawn, without the use of a lawn roller. Two or three neighbors could club together and buy one in partnership, if necessary, but it is a mistake to try to get along without one. Frequent rolling after the lawn has become established makes the turf firm and close and keeps the surface even."

The sandier the soil and drier the situation the greater the benefit of rolling, probably. The following may help readers having to do with such conditions. It is the way to make a lawn in Arizona, according to Mark Walker, formerly of the experiment station of that State: "To overcome

the excessive porosity of the soil, we find it necessary to trench and screen for all border and lawn work—for the latter to a depth of twelve to eighteen inches. After this we harrow in some well-rotted manure, roll down firm and level, then sow preferably blue grass, at the rate of three bushels to the acre, rake in very lightly, mulch with about two inches of coarse stable manure, then water thoroughly and repeat the watering as the top soil becomes dry. If sown in the spring, the seed should germinate in from four to six weeks, and success will be determined by the treatment given in these weeks. When portions of the lawn fail to germinate, we find it best to wait till the rest comes up three or four inches, and then transplant what is needed to fill out the ground, in turfs of two or three inches in diameter, giving a mulch of good top dressing around each turf; this method is preferable to resowing the blank spots. When symptoms of exhaustion appear we mulch quite heavily, as we find the excessive sprinkling necessary to keep the lawns up in good color entails rapid exhaustion of the soil. Rolling and frequent mowing are essential to the acquisition of a really beautiful lawn."

Trenching for a Lawn.—If one wishes to do something very thorough in preparation for a lawn, this will meet the desire: "The best way to prepare the ground for a lawn is to trench it. Stretch strings across from side to side of the plot, two feet apart, and dig off the top soil from this strip to a depth of six inches, heaping it up at the opposite end of the plot. Then go down eight or ten inches with your spade and thoroughly break up the subsoil. For heavy clay soils you will have to dig about two feet deep. After this, spread on well-rotted manure in a layer two or three inches thick, and mix it with the earth. Take up your first string and stretch it again two feet beyond the second one and dig off the top soil from this strip to a depth of six inches, placing it on top of the manure in the first trench. Continue this process until you have gone across your lawn, and when you get to the last strip, cover it with the top soil taken from the first trench. This may seem a good deal of trouble, but it is really not much more work than spading up the soil without method, and it gives far better results."

How Major Hall Made Lawns.—Some years ago Major Hall of Pacific Beach made a lawn on two plots, each 30x15 feet in size. He put a load of manure on each plot, spaded it well, then sifted more manure over the top; kept it wet until vegetation started, then hoed over the entire ground, wet again and let the weeds start again, repeating the operation till all vegetable life is destroyed. He advises not sowing grass seed until it is settled warm weather. He sowed on each plot five pounds of Kentucky blue grass and two and one-half pounds white clover, raked in lightly and kept watered, never letting it dry out even on the surface. In three weeks he began to cut it with a lawn mower. In summer it was cut every day; in winter twice a week. He says the great secret is in having everything grown and hoed

out of the soil before you put in the grass seed, then there will be no having the family and the hired man out to pick weeds out of the lawn. By careful attention it will soon become as soft as a carpet, and far more handsome. He says further that the manure used should be scrapings from the cow yard, not the horse stable, as this alone would burn. He says the fine work is after the ground is made ready by the heavy manuring, in keeping it continually wet and hoeing out all weeds. After the seed is sown be very careful in watering not to wash it with heavy sprays, but with light fine spray that will wet thoroughly but will not move the seed. Do this till it is all up and growing, then wet morning, noon and night. In three days the clover will be up, in five or six days the blue grass, and in ten days you can use the lawn mower, and the more you use it the better the lawn will be. The all-important thing is never to let the ground dry after sowing the seed." Major Hall certainly had rapid grass seed. It usually takes much longer than he mentions to get the mower on.

Mulching for Lawns.—Mr. Winsell enforces the desirability of a surface-cover in this way: "After the seed is sown, it is generally raked in. It is not advisable to cover lawn seed too much, especially the clover, or it will not germinate if covered too deep. As the surface dries out rapidly, especially in the middle of the day, even though carefully watered in the morning or evening, it is almost impossible to start a lawn evenly without the use of a mulch, which prevents this drying of the surface through the day, and baking. The best mulch or covering is old stable manure that has been piled up and heated for at least six months before using. This heating not only makes the manure very fine, but also causes all the weed seeds to germinate and burn up during the heating process. Never use fresh manure for covering a new lawn. The result will be a crop of weeds, barley and oats, and fresh cow manure will produce burr clover and devil grass. An excellent covering for a lawn is the pulverized sheep manure. This, to be in proper condition, should also have been piled up and heated the same as the stable manure, in order that all weed seeds may be killed."

"Many gardeners are using shavings to take the place of manure in mulching. When shavings are used they should always be the coarse kind, and spread very thinly over the ground after the seed has been put in. Never use sawdust. It is too fine and will prevent the lawn from making a good stand. We have experimented with manure and shavings mixed, after having been piled up and heated for some time, and we find it to be a good mulch for a lawn, or even for flowers."

The emphasis laid on avoiding fine stuff which mats the surface too closely is important. It prevents growth from the seed.

WEEDS IN LAWNS.

The writer's experience is that many of the weeds which appear in new lawns can be subdued by keeping the lawns well cut. Other weeds must be hand pulled. We usually begin with a lawn mower as soon as the grass is about two or three inches high, and follow by hand pulling of the strongest growing weeds. A little later it is well to make a systematic weeding. After that continue with the mower, only pulling weeds occasionally as they become obtrusive.

Dandelions.—A pest which one is very apt to get with grass seed, or to have blown into his place, is the dandelion, and it is very hard to extirpate. Dr. R. R. Snowden of Los Angeles says he has done it in this way: "A narrow kitchen knife was sharpened to a square at the end, chisel-like. A little jab below the crown and an upward jerk with this instrument closed the career of one plant; and a half hour each morning for a short time cleared the lawn completely. The larger plants have enough food stored in the root to persist in their renewal, so I pushed a piece of three-quarter inch gas pipe down over each, bringing up the root and leaving a small hole that the grass quickly covered." Dr. Snowden succeeds because he gets so much of the root out. It is idle to pull off the top and cutting avails little unless one gets below the dormant buds which the root-crown has in abundance.

It is possible that broad-leaved weeds like dandelions can be controlled by spraying with copperas water. The Colorado Agricultural College has conducted a series of experiments with killing dandelions in lawns, using four solutions, one of the strength of 20 per cent, one of 10, another of 5, another of 2½. The two stronger sprays killed all the leaves of the dandelion, also somewhat blackened the grass. It afterwards showed a darker and richer green than the untreated areas. The conclusions reached by those conducting the experiments are given as follows: It is evident that a 15 per cent solution should be practically as effective as the 20 per cent for this purpose, and that three applications, the first as soon as the plants are in full leaf in the spring; the second in about three weeks, and the last in midsummer, should prove effective in controlling this pest. Although the grass was very thin on the areas treated it soon began to thicken, and by October 1 formed a fairly close sod. Nearly all the white clover was killed by the two strongest solutions.

Brown Clover.—Another persistent lawn pest is the so-called "brown clover," making a yellow blossom and snapping its seeds widely. It is an oxalis. The only way we know of to eradicate it is to carefully root out every particle of it. If there is very much of it this, of course, is an appalling undertaking, and it might be better to replant the lawn, digging very deeply and being careful to throw every particle of the old sod to the very bottom. We have, however, seen lawns cleaned by faithful hand work

by using a steel table fork, thrusting it into the sod and lifting somewhat so that the root of the oxalis becomes loosened, and then it can be taken out in considerable bunches. Cutting or picking off the top leaves, of course, accomplishes nothing. The use of the fork accomplishes a more complete rooting out than is possible by finger-pulling. The process has, however, to be repeated several times, and one has to be always on the watch for it.

Moss in Lawns.—Moss is a common intruder upon shady lawns and the admission of more sunlight would discourage it. If this is not feasible, irrigation less frequently, but a more thorough soaking each time, will give the surface a better chance to dry off, and moss will not grow on a dry surface. The frequent spraying of a lawn with just enough water to keep the surface moist and not enough water to penetrate deeply will tend to the growing of moss and to less vigor in the growth of the grass. A good soaking of the soil once a week is better than daily sprinkling, but of course very much more water must be used when you only sprinkle at long intervals.

Brown Spots in Lawn.—It is not possible to tell what causes all the brown spots in lawns. We have seen instances we could not explain, and others which were plainly due to different causes. Whatever kills grass makes such a spot and we have found it caused sometimes by white grubs, sometimes by the voidings of dogs, sometimes to excess of lime from the presence of a mortar box during building, where subsequently a lawn was made, sometimes to rise of alkali in spots where the soil contained that substance.

A case was recently reported from Santa Clara county in which there first appeared a round, dead yellow spot. This spot increased, finally recovering somewhat in the center. The dead yellow part becomes a yellow-like circumference of a large circle. Such an instance is interesting because it seems to indicate the formation of a "fairy ring," which is noted in the pastures and meadows at the east and abroad. This is due to the start and progress of a fungus, Marasmius oreades. In course of its attack the center revives and the ring keeps expanding as described, but we are not aware that this fungus has been determined in this State.

As for treatment, the handling of dead spots of all kinds would be similar. Cut out a part of the sod somewhat larger than the spot, remove the earth to a spade's depth, fill in with fresh earth mixed with a reasonable amount of fertilizer, resow the spot or fill it with pieces of sod which can be spared from the edge of the lawn, and bring it along by frequent watering, cutting, etc., to a normal condition.

WORMS AND SNAILS IN LAWNS.

Occasionally a lawn space becomes infested with angle worms, and complaint made that their "castings" have been made all over the ground until the grass is nearly all killed out. This is due to excessive use of

water on an ill-drained spot which drowns out the worms with too much water and perhaps the ground gets too little direct sunshine to promote a vigorous growth of grass which could make good use of the water. Such a piece should be resown after underdraining with tile, or, if that calls for too great expenditure, dig as deeply as can be without disturbing large roots of the trees; clearing out small roots will not hurt the trees and it is necessary to get some free ground if you are to have any grass at all. Dig in stable manure and use with it lime at the rate of 500 pounds to the acre. This will help to discourage the worms and improve the soil also. Then do not water too frequently, but keep the grass growing without making the soil soggy with standing water.

Snails or "slugs" are sometimes very abundant in clover lawns as the result of excessive watering, or at least of too frequent surface sprinkling. When the ground is given a thorough soaking, say once a week, and the foliage allowed to become dry, except for dew, during the intervening days one is apt to have a very thrifty growth of clover and no slugs. On the other hand, clover daily sprinkled has seemed to be almost alive with the pests. Clover does not need as much water as frequently some give it. Try thorough soaking occasionally and stop the frequent sprinkling.

PLANTS FOR GROUND-COVERS.

Ground-covering plants of prostrate habit are largely available to secure a semblance of lawn-like verdure. They are of course not comparable in effect with a good lawn, and, in the writer's view, are inferior even to a fairly poor lawn, but, to say the least of them, they are better than no lawn at all and are rendering wide service along that line. Their chief service, and in that respect they are entitled to rather higher rating perhaps, is the covering of banks and terraces upon which summer verdure with grasses and clovers can only be maintained at too great cost of work and water.

One thing must be insisted upon, however, and that is that they be not expected to look well without a modicum of care, and if possible, a bath now and then for the sake of their cleanliness in the dry season. The particular care which they require is the pulling out of tall weeds and of wild grains and grasses which shoot up through their prostrate growth. Bare ground neatly raked is far handsomer than a ground-cover which is hardly discernible through plumes of dead grasses and weeds, and through a coating of summer dust, blown papers, dead leaves, etc. Therefore, if one decides to forego a lawn and trust to a ground-cover, let him remember that even this must be grown and maintained in a good-gardening way.

There are many plants which may be used as ground-covers, and probably the writer has only seen a fraction of their full number. The characters desirable in such a plant are: flat-growth and little disposition to rise in masses and tangles, which require much pruning; even color of foliage, because dying leaves are inconspicuous; scanty bloom or the absence of it

(unless one choose the plant purposely for the enjoyment of its bloom); dense growth to reduce penetration of weeds to a minimum; evergreen habit and bright green hue, although one may have to sacrifice the hue to secure other good points. In fact, the writer does not know any single plant which has all these desirable traits and is therefore still waiting for wisdom. He mentions those he knows:

Prostrate Juniper.—A plant which serves a good purpose for a flat margin or "parking" along interior driveways or board walks to replace floral borders, which require constant attention to be presentable, is the prostrate juniper (Juniperus prostata). It is, however, of rather slow growth, must be planted with pot-grown seedlings of some age and requires hoeing to kill weeds and hold moisture while extending its branches, which are of the style of coniferous trees except that it shows but little rising tendency. A small, well-kept area of it is quite handsome.

Prostrate Ceanothus.—This plant is Ceanothus prostrata, and is often called "Mahala mat," or "squaw carpet." It is very plentiful in the middle altitudes of the Sierras, and in the Coast ranges, often forming mats or carpets of deep green of considerable extent in quite dry places. It is evergreen and might well replace lawns in the mountains. How far it tolerates other situations we do not know. It roots from creeping stems, but there has been some trouble in making it grow from rooted stems. It is, however, easily propagated from the seed, but this seed will probably have to be obtained from local collectors, as it does not seem to be listed by seedsmen, so far as we have seen.

Mesembryanthemums.—This succulent, called æquilaterale from its fleshy leaves with three equal sides, which one is apt to find installed here and there on the California beaches, wherever it can find a nook out of the sand-blow and the brine, is serving a very wide purpose as a ground-cover. It is very drouth-resistant, and grows easily from long stem-cuttings even carelessly covered with soil, at distances of a couple of feet each way, over the ground to be covered. It grows very flat and its sessile blossoms have no stems to become ugly. Its color is a dark green. Another species, roseum, is grayish-green, with much smaller foliage, also succulent, and is popular for covering rocks, etc. In large area it is inferior to the first-named species, as it grows more densely but presents a humpy, irregular surface.

Wild Strawberries.—The native beach-strawberry (Fragaria chilensis) is a very popular ground-cover; looks well on terraces above rough stone walls, and is also used on large open spaces. It roots runners readily and soon fills spaces between plants set a couple of feet apart. It has large, dark green foliage and white blossoms. Another species is of smaller growth, lighter green, yellow flowers and prominent bright red fruits, which are very beautiful but as inedible as basswood and therefore do not

Rose in Bush Form, Before and After Pruning.

Plate 7: Standard Rose Before and After Pruning—Page 146.

tempt anyone to rob the vines. For small banks this yellow-flowered species (Fragaria indica) is very desirable, but the first mentioned is on the whole better for considerable areas, as it seems to hold its color better and more uniformly.

Trailing Roses.—Several species and popular varieties of running roses have long been used as ground-covers, even involving elaborate systems of pegging down the canes, etc. This involves a great amount of labor and constant pruning away of spent flower-stems when floriferous kinds are used. Even the annual bloomers call for much care because the canes help each other upward and the whole area is apt to become a moundy expanse of brambles in a very short time—which, except with the Banksians, which are thornless, almost defy invasion unless one encases his legs in lengths of stove-pipe. Narrow strips of prostrate roses are more practicable because they can be cut over from the sides. The best rose for a ground-cover, in the writer's observation, is Rosa Wichuraiana, Its small-leaved, glossy foliage is free from rust and mildew and holds a bright green color for a long time. But even this is most satisfactory in borders and parkings.

English Ivy.—A plant found very available for covering dry banks, and for considerable areas also, in Berkeley, is the English ivy. At the University they planted a great deal of it in such situations many years ago as an experiment and have been so gratified with the way in which it covered the exposed surfaces and maintained its green with a minimum of moisture that at present there is a good deal of it on the University campus. Its color is too dark and its associations somewhat funereal, but it keeps down flat and only needs water enough for an occasional bath in the bay climate. It is, however, shrubby and coarse and will not do to walk over, but otherwise will hold green where no plant of a grass character will grow during the summer. It is propagated by putting in cuttings about two feet apart at any time of the year when the ground is a little moist, and they will root readily. English ivy grows well, in the coast region at least, either in sun or shade—running under the dense shade of trees and climbing their trunks, unless hoed out for the good of the trees. It is apt to be badly infested with the black scale and may on this account be very undesirable near fruit plantings.

Lippia.—This plant is at the present time the most widely accepted substitute for a grass lawn and it has many advantages. It is very close to the ground and can be clipped with a lawn mower and thus kept to uniform surface; it is very drouth-resistant and does not show dust badly; it spreads very rapidly, but is not such a pest as some running grasses and is easily destroyed if not wanted for it roots from surface-running stems and does not shoot from underground stems or running roots. It does not produce seed and therefore less likely to appear where not desired. It is of good bright color—superior in that respect to the other plants mentioned

in this connection. Objections to it are several—it does not hold leaves after sharp frosts and the area is left for a time with a dark stemmy cover during the rainy season; its color is apt to be blue-grey instead of green; the desirability of its abundant bloom is a matter of taste, but it is not of long duration and can be removed by mowing. Lippia is propagated only by stem cuttings or by subdivision of the thick turf of roots which it makes. The latter is the easier way and this method is advised by John Swett & Son of Martinez, who have made quite a specialty of its propagation:

"Take a lippia turf fifteen inches square, and cut this with a sharp knife ten times across each way, making one hundred small squares, which is enough for one hundred square feet of surface. Plant small squares a foot apart each way, their upper surface level with the ground. When all are planted water freely to settle the loose earth around the roots. Then keep the ground fairly moist until the lippia has covered the entire surface of the ground, after which it will require water at only long intervals. While the lippia plants are spreading, weeds are apt to come up between them. These should be pulled up or a lawn mower run over at short intervals, thus checking their growth until the lippia is strong enough to choke them out. Lippia will flourish on poor soils and on moderately sloping ground, provided only that it gets enough water in midsummer to prevent the ground from entirely drying out. It stands the wear of feet better than grass, and is excellent for broad garden walks, under hammocks, or for tennis or croquet grounds. When watering at considerable intervals, use an ordinary lawn spray, applying always enough water to sink deep into the ground."

Flowering Plants for Ground Covers.—On the open spaces in small gardens low-growing flowering plants are sometimes effectively used as ground-covers. The writer has seen pansies, marigolds, verbenas, etc., thus employed. Those which volunteer freely from seed can be renewed from time to time by raking off all the old plants and giving the seedlings a chance to make a new cover. Verbenas and other similar plants can be mown or otherwise cut a few inches above the ground to renew the foliage and preserve the flat appearance.

CHAPTER XIV.

THE ROSE.

For the greatness and the gladness of it in California, the rose is rescued from the later chapters on shrubs, trees and vines, although the rose blooms on all of them, and placed here, alone and first of the garden flowers to be separately characterized.

The rose came to California at creation's noon day, judging by the natural beauty and finish of the three indigenous species. Next, perhaps, came the Castilian, for the Spanish pioneers could hardly have forgotten the roses of Castile when making plant collections which would comfort, sustain and perhaps assist them also, while pursuing their arduous task of softening the savage, aboriginal heart. With the early American settlers, who came first seeking pelts and afterwards gold, and with the people of all nations who joined them in the latter quest, there came the best roses the world possessed at the middle of the last century. Rose slips crossed the plain in the old emigrant wagons, and planted beside the miners' cabins on the hillsides or near the bars of the rivers, or beside the first farmers' shacks in the valleys, grew beyond all measures prevailing in the places whence they came; they embowered buildings, they laid hold on native trees and shot their streamers of bloom beyond the branch-circuit of the pines or garlanded the heads of stalwart oaks. As residential buildings statelier grew, in the development of the state, the rose advanced, clothing their sides and softening their roof-lines until it would be difficult now to find a California home or a California heart which is not loyally and joyfully beneath the dominion of the rose.

But the beneficence of roses in early days should not be forgotten in worship of present supremacy. It is fit to tell the children how those cuttings crossed the plains, cherished and kept moist all the weary way that the pioneer women might have a reminder of home in a new, strange land. And how those pioneer roses reveled in the warm, red soil of the foothills, and cheered many lives which were full of loneliness and longing and often of deep disappointment! With what affection the roses spread a mantle of beauty and fragrance over the forsaken ruins of deserted camps, and how they grow to this day in such solitary places until their stems look like the trunks of old grape vines, but are still full of sap to push out new wood and new bloom aloft—joy but to the birds and the passing travelers.

The Rose in California Life.—There are few, if any, places in the world where the rose enters more fully and constantly into daily life than it does in California. There are many places probably where

finer single specimens can occasionally be seen, for there are people who have developed horticultural art in the rose more carefully and generously and where this art, and professional effort to promote it, secure single blooms for exhibition or quantities of bloom for commerce which surpass California rose products because we give a minimum of attention to the rose that way. On the other hand, the roses in common gardens and the roses which break free and surmount trees and buildings, making the landscape brilliant with their beauty and the air fragrant with their perfume, are probably as fine in these ways as roses are anywhere.

Some of our engravings are suggestive of the rose as a decorative plant for home adornment. It is remarkable how cheap a habitation can be transformed into picturesque beauty and charm by the use of a few rose plants. These plants may be allowed to run riot, and they will develop a wild beauty which is irresistibly charming, or they may be carefully trained to carry bloom and foliage close to the supporting structure, and thus preserve its outlines as the neat gardener will prefer. In either case the rose is willing and grateful, and therefore delights all tastes in the gardening art.

Another manifestation of the love of the rose for California is the rose bordered driveway, which is so popular in our rural and suburban districts. Here, too, the rose accepts the owner's desires, and will make grand standard trees or shapely bushes according to the pruning which is given, or it will rush into continuous banks, and by intertwining take possession of the whole roadside spaces.

It is, however, as an arbor plant that the rose comes most fully into California life. To live under the rose is literally a possibility in California. Under the shade of the rose the hammock can be drawn and the table spread for al fresco refreshment. Many a rural table is spread for months on a rose fringed veranda or in a simple arbor made of poles to support the masses of rose bloom and foliage in which the birds build their nests and from which their songs break forth to greet the dawn or dismiss the evening twilight. California open air life is delightful and the rose is its charming priestess.

Famous Old Roses.—Almost from pioneer times California publications of all kinds have given measurements of the growths of rose-trees, rose bushes and rose vines, as to be seen in different parts of the state, and the rosarian, statistically inclined, could easily find data for a treatise on the subject. It did not take the pioneers long to ascertain that choice varieties which could only survive an Eastern winter with glass above and steam below were at home in open air in California and reached a breadth and stature rivaling even that of the Sunny South of America or France. The result was that such roses were early distributed in this State, and each plant brought into a

locality became mother and grandmother of a numerous progeny within a twelve-month, for every fragment broken for a friendly visitor took root and gave branches for new breaking and new rooting. Poor, indeed, has always been the California home which has not its climbing roses high as a house and its bush or tree rose as big as a barn—the constant joy of the resident and the wonder of the tourist.

Space cannot be given to description of these rose-wonders of California and yet the distant readers may justly claim something specific. Let them be content with the records of a Beauty of Glazenwood near Los Angeles, growing to the top of a eucalyptus tree eighty feet high and turning its support into a colossal pillar of bloom of exquisite rose-pink and pale yellow; of a La Marque at Santa Clara encompassing sides and roof of a cottage to an area which may be inferred from the measurement of its main stem, which was forty-four inches in circumference just above the ground. And to these may be added the fuller details of a rose bush at Ventura three feet in circumference at the ground. The first branch, which juts out at a height of about four feet from the ground, is eight inches in diameter. It was planted in 1876 from a slip obtained at the Centennial Exhibition, and, although several wagon-loads of limbs are annually pruned off, it now covers an area of nearly 2000 square feet.

Requirements of the Rose.—The rose is a very grateful plant in California. In all parts of the State it finds conditions to its liking. It makes glorious growth by the seashore, in the coast valleys, in the great interior valley, in the foothills of the Sierra, and it goes up the mountain sides, thriving at as great an elevation as permanent habitations have yet been carried. It accepts all wholesome soils, from heavy clay to light loam, providing it can find an adequate degree of moisture and it endures hardships during the dry season to break forth into the gladness of the California winter during which it makes a grand bloom, maintaining it into the early summer without aid from the grower, or receiving such help in irrigation will either reward it by continuous bloom, or, taking a brief rest in midsummer, will break forth into a new spring-like bloom in the delicious autumn days.

But though the rose will do this for itself, and almost by itself, it ill befits California hospitality to place such stress upon it. It is more easy to grow great roses on the heavier rather than the lighter loams, and easier to improve a clay toward the loam type, as is discussed in detail in Chapter III, than to get such degree of firmness and retentiveness as the rose enjoys in the sandier soils and yet these, too, are capable of sustaining grand rose plants with generous use of well-rotted cow manure and water. Perhaps the amateur should remember that the rose, more than many other flowers, depends upon what he does for it, generously and intelligently.

PROPAGATION OF THE ROSE.

Except for origination of new varieties, the rose is seldom grown from seed. It is usually rather difficult to start a rose plant from seed and one must not be impatient over its delay. Sometimes it takes a year or more and a good way to wait is to mix the seed after taking out of the hip or "rose apple," when it is fully mature, and mix it with sand in a flat (see Chapter VII) and keep the box in the cold frame or on the greenhouse bench, where it will get a spray once in a while to keep the sand moist but not wet. Examine from time to time after a few months and sow the seed as it begins to germinate. When the plants begin to bloom you will think you are entertaining the whole rose family.

Practically all rose plants are grown from cuttings, which grow readily both as hard and soft-wood cuttings, and each class is to be treated somewhat differently, as suggested in Chapter VIII. Soft-wood cuttings in the case of the rose are firmer and more woody than those taken from herbaceous plants and do not require so much heat and moisture. In fact all rose cuttings are fibrous; if they should be distinguished as growing and dormant wood the terms would be better than to call them soft and hard.

Growing From Short Cuttings.—The millions of little rose plants which go by mail are started in sand beds in propagating houses with very gentle heat. Since parcels post has prevailed there is more traffic in the stronger plants grown with less heat, or often in California with no artificial heat at all, from larger cuttings. The short cuttings are made from small new wood, with removal of leaves only from the part which is to go below ground. Three inches is about the right length—one eye beneath the sand and two above. It is claimed that the leaves should remain on the cutting to shade the eye and to prevent the eye from making too rapid growth before the roots are well formed. Sometimes a cutting will put out a fine top growth and in ten or fifteen days gradually damp off, and the cutting has rotted. In some cases this is because the cutting is too pithy or the eye has been too advanced. Rose cuttings can be propagated any time from July till February. The safest time is after October, as the cooler months are more desirable. Great care must be used in propagating during the hot months.

The sand boxes of small cuttings will sometimes bring good results in a sheltered, warm spot in the open air, but the cold frame or the green house bench is a better place for them. The sand can be more easily kept damp, not alternately dry and wet, under cover. When the plants show by their enduring growth that they have rooted they can be gently lifted out of the sand with their long thread-like roots and potted in a good soil mixture or even set in open ground if soil

and temperature are right. A shift or two before setting in the open is, however, desirable.

Growing From Long Cuttings.—The growing of roses from long cuttings of dormant wood is according to the suggestions made in detail in Chapter VIII. Cuttings are preferably made of straight, well matured shoots of the last growth, although others, even of old stems, will often grow well. The cuttings should be about six inches in length, from a quarter to half an inch in thickness and if sprouting from below ground is not desired the buds from the lower part of the cutting may be pinched out. This will retard sprouting, though not wholly prevent it, for latent buds are apt to be developed. These cuttings may be planted in the open where bushes are desired, during the early part of the rainy season, when the soil is right. In such rough work it is a surety of getting a plant to plant four or five cuttings where the plant is wanted. Some growers are sure that cuttings "like company," and most of them are almost sure to grow. The surplus plants, if any, can be transplanted. In such a case, as in all handling of cuttings, the planting should be done with a dibble or trowel and the cutting carefully set with the earth firmed into close contact with the base of it. Rose cuttings will often grow if simply pushed into the soil, but if this requires force it is apt to upset the cambrium layer and callusing becomes thereby more difficult. Therefore cuttings should be planted and not "stuck into the ground."

To secure a clean-cut base; to secure also the "company" advantage, if there is anything in that, and to serve convenience in keeping everything in good order, the cuttings should be carefully planted in a trench, as shown by the figure in Chapter VIII, which also shows what a good hardwood cutting looks like. Planting in a trench enables you to see just how the cuttings are set—that they are not hanging in an air-cell and that the soil is firm at the point where the roots will start, viz.: from the callus which will form at the cut end. After the cuttings are set and the trench filled, with the soil loose near the surface, a litter or mulch of leaves, lawn clippings, or a covering of sand will keep the surface from too great compacting by rain or sprinkling and subsequent drying, baking or cracking by sun-heat or dry air. Usually the amateur can get all the rose plants he desires by reasonably following these suggestions. From such cuttings set in the autumn or early winter, one is apt to get blooms in May and a good sized bush for transplanting in a year from starting. If it is desired to develop the growth from one bud and escape shoots from below, all buds below the top one should be cut out before planting.

Rose Cuttings Wrong-End Up.—All that has been said refers to planting cuttings right-end up: just as they grew and are expected to grow. To get the highest percentage of success with cuttings and

to help those which do not root readily, it may be desirable to cover them in for a time, wrong-end up. To understand this practice it must be remembered that the root starts from a callus; that a callus is developed from the exposed cambium; that the activity of the cambium, in forming new cells to compose the callus, is dependent upon the right degree of heat in the soil; that this heat is found, in the California winter sunshine near the surface of the soil, while a few inches below the soil may be cold and wet and right to encourage continued dormancy in the cutting. To bring the lower end of the cutting into a soil-warmth which will encourage callusing and root-formation, therefore, the cuttings may, to advantage, be placed bottom-end upwards—for temporary development, not, of course, for top-growth. In a hot bed or a green house with bottom heat, this condition does not prevail and cuttings are set right end up because the bottom heat makes the lower layer of the soil warmer than the upper.

This treatment of rose cuttings in a callusing bed before planting in rows for rooting has been described in detail by Mr. Luther Bowers of Santa Clara County, in this way:

"I gathered the cuttings during the Christmas holidays, taking only the last season's growth, and, if possible, the growth next to the top end. These cuttings were made as near 6 inches long as possible. The base or lower end was cut off just below a bud and as close to the bud as possible without injuring it, and the top was cut off just above the bud, so as to have the cutting as near 6 inches long as possible. I then tied the cuttings up in bundles of twenty-five or fifty each, using fine copper wire or willow—something that would not rot or rust. Iron or galvanized wire will not do, as it will ruin the cuttings wherever it touches them. The bundles should not be too tight, but just tight enough so that none of the cuttings will slip out. I put on each bundle a label made of a piece of sheet zinc and the name written with a common lead pencil (which will last for years under ground).

"I dug out a place, where no water would stand after a heavy rain, to a depth of eight inches and made the bottom perfectly level, and I then put in a 12-inch board on each side and had a box 12 inches deep without top or bottom, ten feet long and four feet wide. In the bottom of this box I put three inches of sand—very fine. I then put in my cuttings, standing them up in the sand so that they were at least three inches from either side or end, and just three inches from the top. These cuttings were all put in upside down. The bundles should not touch one another. The same kind of very fine sand was then filled in and around and all over the cuttings, giving about three inches of sand above the ends of the cuttings. This bed of cuttings I never let get dry, neither did I keep it too wet, by covering the whole with one

thickness of burlap. This will prevent evaporation and hold the moisture.

"After the ends of the inverted cuttings were well callused and were making fine rootlets nicely they were taken up, separated carefully and planted in a hotbed. To begin putting in the bed, a wall of sand should be placed at one end; the sand should be moist enough to stand. Place the cuttings in natural position 3 inches apart; again wall up the sand, then another row of cuttings. Where room was scarce, I have placed the cuttings as close as 1½ inches and the rows only 2 inches apart. When I have a section planted I give a good soaking and put the cover on.

"The cover for this rooting hot-bed, which was made 6 x 16 feet, was made with cloth house-lining. Cut the cotton 6 feet 8 inches. sew it the short way, tack one side to back of bed and the other side to a 1 x 3-inch strip 16 feet long. This can be rolled up and the strip will hold the cloth in place against the wind.

"The same plan can be followed in a small way. and if pains are taken the hotbed can be dispensed with and the cuttings can be taken from the callusing bed and planted in rows in the open ground. In this case when placed in the callusing bed they should be set in rows singly and not over 2 inches of sand should cover them, and they can be left a little longer. The soil where they are planted should be very rich with cow manure, well prepared, and several times worked at least one month before wanted, and the soil kept very fine. Or, if one should want to use a hotbed, take the cotton lining of a sugar sack and make a hotbed just 5 inches narrower each way than the cloth is when opened. Tack one side to the top and tack the other side to a strip or old curtain pole or broomstick to roll on. A bed of this size will hold 100 plants. If directions are followed not 5% will fail to grow."

Mr. Bowers' careful method is given with much detail not only because it will give good results with roses which are rather hard to start, like Perle des Jardin, Marechal Neil, Lamarque, La France, Baroness Rothschild, Mabel Morrison, Mad. Gabriel Luizet, etc., but because it is available for all kinds of hard wood cuttings, which need promotive treatment, and becomes, in that way, supplementary to the discussions in Chapter VIII.

Budding and Grafting Roses.—The rose can be very easily either budded or grafted by any of the simple methods described and illustrated in Chapter VIII. Budding is the method generally employed and it can be successfully done all through the active growing season of the rose whenever you can find the bark lifting well and well-formed buds to put in. If there is any "best time" it is after the spring bloom, as soon as the buds below the bloom are plumped out well and before

they break into lateral shoots. You can tie with rafia, but any soft cotton string or yarn works well. Of course no wax is necessary. In about two weeks, or when the bud shows signs of growth, cut the string on the opposite side from the bud. The top of the stock can be cut off or bent over, leaving two or more eyes, as it is usually claimed to help draw up the sap and nourish the new bud. Our notion is, however, that the gradual removal of the top is to reduce the sap pressure of the old stem until the bud makes growth enough to take it all; for we have seen buds "drowned out" by bursting sap. However that may be, it is a good practice not to cut back too sharply at first, if you are putting buds into a very strong old plant.

Grafting can be done in the root, at the root crown, or at any point above where the stem is hard enough to hold the scion well. Grafting methods are also explained in Chapter VIII.

Whether roses should be budded upon a different root than that which can be secured by rooting a cutting of the desired variety, or whether they should be grown "on their own roots," is a question which has been energetically discussed for decades in California, and the general conclusion must be inferred from the fact that probably not one rose in ten thousand now growing in this State, away from parks and other professionally-kept places, ever felt the push of a root other than that which it made for itself. The general attitude of amateurs seems to be to discard the relatively few varieties which do not have appreciation enough of the good things of California to root themselves strongly and be vigorous in wood-growth and bloom. We have no dispute with professionals, who are wise on stocks, or with nurserymen who may find it to their advantage to grow budded roses largely; we are simply stating the prevailing amateur way. It is not necessary to enter the discussion of "wild stocks" for the rose; the amateur pays little attention to them. If he finds a rose which on his place is a poor grower, but too good to throw away, he simply buds it upon any surplus bush he may have, of a strong growing kind, and generally he gets satisfaction. Really, we never could see why a California amateur, growing roses in the open air, need to go hunting brambles and briers, which usually do not get half the size and vigor of scores of our own-rooted, improved roses. Why should he seek thirstingly for a suckering, rusting, short-season wild thing, which never can grow higher than his head, perhaps, when he can bud into a Banksian which has run all over his barn with almost evergreen foliage, free from rust and mildew, with root non-suckering, and wood free from thorns—or use some other strong growers of which every rose garden is full of conspicuous examples. If, however, the reader must have the name of a stock for budding, let it be the old Manetti, the cuttings of which were first imported from France, as they are deep

rooted, non-suckering, and furnish a continuous flow of sap, which many stocks from winter climates fail to do. But we fear we are really arguing a question which we decided not to do. Reference to it must appear again later in connection with the training of standard roses.

PLANTING THE ROSE.

Ground for planting roses should be most carefully prepared with due observation of the best conditions of soil and tillage as described in Chapters III and IV, and the hints on planting in Chapter XI, if one is planting strong field-grown roses, which are a specialty of California nurserymen and which gain development impossible elsewhere because our growing season is so much longer. Many carloads of these field-grown roses are produced each year in California for eastern shipment. The little plants from small cuttings are grown under glass and set in the field rows. It has been demonstrated that La France, American Beauty, Mrs. John Laing, and other roses which are very slow growing out doors at the East, and of which it is impossible to grow very strong plants even in two seasons, will, in California, make plants three feet or more in height in one season. Such sturdily grown plants are as strong in transplanting as a deciduous fruit tree, but, for all that they should be well planted in soil most thoroughly prepared. Such a bush, however, is not so tender and can be planted through a wider range of temperature than can the little semi-herbaceous baby roses which come straight from eastern hot houses. These little babies will do well, however, if carefully set during the rainy season when the soil is amply moist and warm and in working condition. They should never be put into cold mud or hot clods. They should rather be potted and held for time in the frame or the greenhouse until the soil and weather in the open are just right, and if it is late in the rainy season or early in the dry, they should be shaded until they take to making new leaves.

Distances for planting roses will depend upon your available space and the effect you desire to produce. If you want good shapely single growths, either as bushes or standards, a distance of four feet each way allows such development for a number of years, if proper pruning is done. If you want to produce a mass-effect for a maximum of flowers of fair size and are willing to prune constantly for new blooming shoots, they will go for some time at two feet intervals. For a dense hedge we prefer three feet between plants, while for trellises, fences, arbors and pergolas, a distance of six feet seems none too much for short-climbers, while for our freest running roses on arbors, etc., one plant will soon cover five hundred square feet if the canes are properly laid and fastened. For quick results plants can of course be set closer

and transplanted for use in newer beds or on newer garden structures. As with most other plants, roses at first are usually not given enough room for free development and strength, for a plant grows with the sky as well as with the soil.

As soon as a rose is planted it should be given a certain amount of cutting back, shortening a lot of side branches which are weak and unpromising, to a single bud near the stem, from which they may make a new break; removing some of the side branches which may be starting too near each other to grow well; cutting back near to the root some of the main stems, when there are too many. No exact rule can be given for the number of stems to retain at planting. It may be three if the growth is strong and the root large; it may be only one and that shortened, if the plant has a weak look. If one must have a rule, until he fully learns that there really cannot be one, let him cut away half the top—if the nurseryman sends him the bush just as it has grown. Later he will learn to cut back according to the look of the plant and what he knows of the variety.

CULTIVATION AND CARE OF THE ROSE.

Losing sight for moment of the pruning, which will be discussed later, the amateur should be assured that he should nearly always be doing something for the thrift of his roses. The principles and purposes of tillage as sketched in Chapter IV should never be forgotten; the hints for work in the different months in Chapter XII should always remind the grower of the rose of something. Perhaps the too common belief is that if the rose is treated well during the winter it may be left to shift for itself during the summer. The fact is just the reverse. If the rose is treated as it ought to be in December it can almost be left to shift for itself until May, but from May to December it should be almost constantly under treatment. It is therefore the rose of summer which depends largely upon the grower's attention and care. Without this, the aspect of the dusty bushes, with their load of dried bloom and foliage shriveled with mildew or tarnished with orange rust, can evoke but a single thought, and that is commiseration. The owner commiserates the bushes and possibly condemns them; the passing rose grower commiserates or condemns the neglectful owner. Plainly it is not the fault of the bushes that they have fallen into such straits; how can they be helped out of them?

It is perhaps impossible under ordinary conditions to obviate the midsummer droop in condition in the rose garden, but it may be unquestionably greatly mitigated. The distressful aspect of the neglected garden can certainly be prevented if one has a drop of water more than he needs to drink. If he has enough to wash himself in he could keep quite a large plantation of roses in fair condition, providing his interest and devotion prompted him to put the waste water where it would do

the most good. If he has water enough to flow in a hoe-ditch or to run from a hose, he could reclaim his rose garden, if he had the time and the will, and the latter usually finds the former.

But though water applied so as to cleanse the dust from the foliage and thoroughly moisten the roots of the plant is the chief essential of midsummer decency and comfort to the rosebush, it is not the only desirable thing, nor can it by itself give full satisfaction. The whole year has its successive duties which the grower owes his rose, and condition at any time depends much upon foregoing treatment. He who prunes his bushes guillotine-fashion in the early winter, digs in a coat of manure and then thank his stars that the roses are fixed once more, will get some good spring roses on some bushes and some magnificent blooms, perhaps, on others, but some will not bloom well and all will be in distress in midsummer. One heroic treatment a year, followed by neglect, will not enable the rose to do its best.

It seems to be generally known that removing the fading blooms will conserve the strength of the plant and encourage it to put forth more bloom. Acting upon this belief, some growers go among the bushes, taking off the old bloom as though they were picking cotton. Others take small scissors and clip off the bloom with as little stem as possible, as though every particle of wood was precious to the bush. Others do a little better and cut off the old bloom just above the first leaf on the stem below it. All these treatments are better than neglect. They all obviate the distressful appearance of a bush full of dried bloom, and all free the plant from exhausting effort at seed formation. It is possible, however, to pick roses and to cut off old bloom in a way which will maintain good condition in the bush, lengthen its flowering period and reduce the extent of heroic pruning at any time. It consists simply in cutting with a long stem, the length dependent upon the habit of the variety, down to a good leaf bud, from which a strong new shoot will start. This applies both to gathering good flowers and to clearing the bush from dried bloom. When the buds are opening one at a time on a spray, they may have to be cut with short stems, but when the last bloom of the spray has come to its best, it should be severed clear down to a good bud below the branching flower stem. If this practice is observed, the bush will be freed from the mass of brush and the hosts of weakly shoots which can yield no satisfactory bloom. New shoots will be strong and the whole foliage of the bush large and vigorous.

A bush thus treated during its winter and spring flowering period comes to midsummer in far better condition than one which has been allowed to take its own course after its winter pruning. If, then, when the spring flowering is over, the bush be looked over for weakly shoots, or for overcrowded growth, and these removed, it will be trim and

vigorous and ready to take on a new growth for fall blooming. With its roots well protected by a mulch, or by deeply pulverized surface soil and its top thinned to admit sunshine and air, it becomes far less subject to parasitic insect or fungus. Such a rosebush shows its master's care and repays it as only a lovely, fragrant rose can do.

Of course the writer does not intend to convey the idea that the rose should be kept always blooming. Read the hints for July and August in Chapter XII on that point. The rose is better after a degree of dormancy in summer, but that does not mean distress. It should have moisture enough in the soil to escape that. The leaves do not need to fall nor the newer growth to shrivel. If the soil is properly retentive and is protected by cultivation or mulching, the rose can do without water for a time. One should give the plants a rest, but be reasonable about it. The grower must soon learn by observation that all classes of roses do not rest alike. Some of them sleep with one eye open; others close both eyes and snore. Let each rest in its own way, but remember that resting does not mean drying up.

PRUNING THE ROSE.

Some phases of pruning have already been anticipated in the discussions of planting and summer care of the rose in this chapter, and some of the general principles which one must observe are suggested in Chapter XI, and timely practices are outlined for monthly work in Chapter XII.

It must always be borne in mind that the rose blooms upon new shoots; that large roses, according to the size-habit of the variety, are borne upon strong new shoots; that strong shoots come from older wood of good diameter, according to the growth-habit of the variety, and that shoots will be stronger if the root has not too many of them to provide for. Pruning is, therefore a process of forcing the root to produce, not only new shoots but strong new shoots.

For these reasons, the secret of having fine roses, after the moisture and fertilizer are looked after, is to regulate the amount of blooming wood the plant is to carry and to be sure that it is all new and strong, and not too much of it. This means that there should be continual pruning out of old wood which can only yield weak bloom shoots and the clearing out of weak shoots when they come even from good leaders.

It may be reasonably contended that if one grows his roses in tree-form, it will be easier to discern these characters and to secure them by pruning, and this is one of the arguments for growing standards or small rose-trees, because the grower has constantly before his eye the conception of a small tree form to be maintained. It is expected, of course, that he will not attempt to maintain this form with the hedge shears, but will maintain it by shortening in and by choice of

buds, to induce growth in whatever direction is desirable to occupy vacant space and secure symmetry. Doing these things which are essential to the growth of a decent tree form also ministers to the choice of the best wood to make that tree and the rejection of inferior wood. If that is done one is sure to have the best roses his local conditions of soil, climate and moisture supply will allow.

With the rose in bush form the incitement to this work is much less. The natural bush form gives a very agreeable outline, and the temptation is to let it alone until it becomes a mass of brush, through which new shoots have to push out strongly to get the light. The plant is allowed to carry too many flowers, and as a result they are apt to be light and small. When the resolution is reached that the large plants must be trimmed, it is found almost impossible to reach the interior except by beginning at one side and working straight through, leaving a few good branches of the more recent growth and pulling and cutting out all others. This, of course, restores the bush by starting a fresh growth all through, and it is a good thing to do, but it is such an undertaking for an amateur who does his own work that is apt to be deferred for two or three years too long.

Is the Standard or Tree-Form Better Than the Bush?—It is indisputable that, with proper pruning, good strong growth of wood and large fine flowers can be had with either form. It has always seemed to us, however, that the standard form was stimulative of better culture, but we have to acknowledge we have as yet reached no final conclusion on the matter. We began by growing all roses in bush form. After a few years we changed all strong growing varieties to own-root standards. Later we allowed about half of them to resume bush-form, and as they are nearly all superannuated now we are planning to renew the plantation intending to grow all varieties which will accept the treatment as low standards, just as we do fruit trees. Standards three or four feet above the ground are far less desirable, in our opinion, than those about two feet from the ground. We are, however, quite firm in our belief that, except in the case of a few roses which are notably poor growers on their own roots, the amateur should have his roses on their own roots, whether he grows them in bush or tree form. We have made hundreds of very satisfactory standards by selecting the best shoots of plants grown at first in bush form, and know that it is feasible to do it in the way which will be described below. It has a safety feature also, because injury to the stem can be speedily nullified by growing a new stem, and if one tires of standard form he can quickly restore the bush form.

Advantages and Disadvantages of the Standard Form.—Many enjoy the neat, clean, tree-like aspect of a rose grown as a standard rather than in bush form, and are not offended by its artificiality. Aside

from this, which is a matter of taste, there is an advantage in the fact that a well-kept, thrifty standard is likely to give single blooms or clusters of them which are in size and substance superior to those found on bush roses. Sometimes this is due to the fact that, in budding, some roses are given stronger roots than those which naturally belong to them—and this is the chief reason for the standard, except in formal gardening where their form is essential to the effect desired. But aside from these considerations, it is a fact that one is apt to get better roses on a well kept tree-form than on a well-kept bush-form, simply because there are fewer flowers for the root to minister to and it can therefore force them to fullness. But there are fewer flowers and therefore the mass-effect in less and one will get less satisfaction in cutting flowers from a standard generally than from a bush. It is also true, probably, that standard roses are shorter-lived. Though the head may be renewed by pruning for new wood, the stem is not, and when tied to a stake and with the top constantly checked from expansion, the bark sunburned and hardened, the growth reduced in thrift by bark-binding, decrepitude follows. And yet, own-root standards, given rather more fredom in top growth than formal requirements permit, are certainly long-lived, probably in part because they shade their own trunks more or less, but mainly because the plants are naturally strong and vigorous.

Developing An Own-Root Standard.—The fundamental proposition in developing an own-root standard is securing of a good stem of desirable height and that is the product of a strong root, and root strength is in part due to leaf-action. Therefore to get a shoot of satisfactory size, one usually has to encourage growth in bush form and to give the little plant advantage of all the leaf growth on the small shoots it makes at first and wait for the appearance of the strong sucker-like shoot which it will usually make in the second year after planting, if it is naturally a strong grower and becomes well established. Let this shoot grow unchecked and blossom. Then cut back to whatever bud below the bloom-head is nearest to the height you prefer as the top of your main stem. Laterals will begin to grow from several buds just below this point and of these reserve three or four which are properly placed to secure symmetrical branching, and pinch out the others. This will usually be done in the fall or winter pruning and then all the growth except the single stem is to be removed and the stem itself tied to a stake for support and protection. All rejected shoots should not be merely cut at the ground surface: remove the soil and cut them away cleanly close to the root and thus remove the dormant buds which are usually numerous at their bases. This causes the root to throw all its force into the single shoot which you have chosen for the standard and the growth of its laterals is thus made

more stalwart. Watch must be kept continually for suckers starting from the root and shoots too low on the standard stem; these are to be removed as soon as seen. New shoots in the head, or upper part of the standard may be allowed to grow if such are needed to give it a denser or fuller tree-form, but after that additional breaks of buds should be rubbed off, except as needed for new wood to replace older growth in the regular renewal system of rose-pruning which has already been insisted upon.

Own-root standards are naturally best of the strong growing varieties. Weaker growers which seem not disposed to make long shoots from the root may be given standard form by taking the best shoot to be found and cutting that back to make good bud. Then train the growth from that bud to a stake, clearing away all others which may start. This shoot may be topped, if it reaches the height desired for the standard stem, or, if it falls short of that, it too must be cut back to a bud and trained to the stake. Such development of a standard by successive stem-growths is apt to give a spindly, more or less crooked, stem and therefore it is better to make standards of such varieties by budding into a stronger stem of a good stock and thus making what is called a budded standard rose.

What Stock for a Budded Standard?—We do not speak for the professionals; many considerations are involved in their work which do not impress the amateur. Our experience has justified us in taking cuttings from any rose which makes straight, stalwart canes and is therefore a strong grower. Mr. F. C. Havens, a most successful rosarian of Oakland, decided upon the Prairie Queen as the best stock, after long experimentation with other roots. Certainly we have never seen better hybrid perpetuals and hybrid teas than he has grown upon Prairie stock. But we doubt if one need be restricted to particular stock. A cutting of any strong-growing variety will advance into such a tree with such training as has been described. As already claimed, it does not require a briar or other foreign root to accomplish it. Rich soil and sufficient water will make a rose tree in California valleys or foothills without recourse to hardier stock than most free-growing tea-roses possess in their own roots. Of course, to secure full-sized blooms, systematic pruning and thinning of shoots and buds are necessary. and yet rose trees left almost entirely to their own ways, produce wonderfully large as well as copious bloom. They attain, too, a self-support which makes a stake as useless as it would be to an orchard fruit tree. The best demonstration we have in our garden at this moment is an own-root standard, Dr. Grill. For floriferousness during a long blooming season it surely is a sight to behold.

The Operation of Pruning.—So many hints of the practice of pruning the rose have been given in Chapters XI and XII, and in various

relations of pruning to form, vigor, blooming, etc., in this chapter, that no connected discourse on the operation of pruning seems required. The best way to learn pruning is to prune yourself, note what you get and watch the successes and failures of others. The best teacher of pruning the rose is the rose itself, if you will try to understand its sign-language. The writer's methods with both standard and bush forms is suggested by plates from photographs taken on the before-and-after policy of demonstration.

Pruning According to Variety and Class.—The treatment of varieties according to their vigor and disposition is a thing which must be learned by experience. There is also a difference in pruning according to classes, of which the following by Mr. F. H. Howard of Los Angeles is a very succinct statement:

"It must be remembered that different roses show different characteristics of growth, and the operator must use judgment in handling the shears.

"Take for example, roses of the hybrid perpetual class, the plants make but a comparatively small amount of twiggy growth, while the tea and hybrid tea section produce a great deal, which, unless removed at least twice a year, simply consumes a quantity of sap without producing blooms, or if any they are short stemmed and of poor quality. In pruning varieties of the hybrid perpetual class cut them back about eighteen to twenty inches above the surface of the ground. This applies to plants of moderate size, say three to four feet high. Where they are larger they may be left somewhat longer. Remove all small canes, cutting them off at the surface of the ground, and in selecting those which are to be left make certain by careful examination that the stems are well furnished with plenty of plump, healthy eyes.

"The hybrid tea and tea classes of roses are the most satisfactory in blooms, and at the same time the most difficult to prune properly. To begin with, remove all small twiggy growth, pruning the plant back to approximately two-thirds of the total height. Carefully remove all dead wood and all stems, large or small, wherein the bark shows a tendency to crack or is otherwise in an unhealthy condition.

"While it is better to leave some foliage on the pruned plant, the removal of the greater portion will in no wise injure it.

"I have often seen so-called gardeners, and others, cutting off suckers which issue from the base of the plant grown in bush-form—little realizing that they were ignorantly destroying the best efforts of the plant to produce fine flowers.

"Do not be afraid to cut out all worthless wood, and with the exception of roses grown to standards with their typical symmetrical heads, do not try to shorten all the growths to an even height with

the idea in view of obtaining a bush of rounded form. The new growths which follow a pruning are irregular as to height and it is impossible to keep the plant in anything like formal shape."

CLASSES AND VARIETIES OF ROSE.

For the reasons stated in the preface to this work, the writer cannot enter into a description of rose varieties nor need he undertake discussion of the classification of them. The amateur will usually find in the excellent special catalogues of California nurserymen, who are doing most with rose propagation, all that he needs to lead him to growth and intelligent enjoyment of the flower. These publications will indicate the varieties of different colors which have established themselves in California esteem and are therefore best for a beginner to plant, although he will be pardoned for dipping into novelties if he cannot resist the alluring descriptions given of their desirability.

In general it may be said that the roses commonly grown in California are the highest of their several classes, including practically all those which are pronounced tender and delicate, and for which, in wintry climates, growth under glass is prescribed. The best roses of moderate winter climates are also grown in California. The only ones which may be looked for in vain, except in the mountains, are the extra bardy or iron-clad kinds. Our climates do not require them and they are therefore rejected in favor of roses of higher quality and of repeated or continuous blooming.

CHAPTER XV.

THE CARNATION.

California has always done creditable work with the carnation, although the growing of it has been largely restricted to the coast region from San Francisco southward, where soil and temperatures seem best to meet its requirements as an open-air flower. It has naturally seemed to associate itself closely with popular seaside resorts —both the sand and the moist summer air being apparently to its liking, while the popularity of the flower, for its beauty and its delicious perfume, appealed strongly to coast resort-managers as an added attractiveness of their places to those who joy to linger by sunset seas. But while these natural and commercial qualities have linked the fame of the carnation with that of the coast, amateurs in other parts of the state can certainly enjoy it if they will make proper effort to adapt their cultures to its requirements.

Localities which figure most prominently in the California history of the carnation are Coronado and Redondo beaches, Santa Monica and Santa Cruz, while San Francisco won carnation fame through the achievement of Mr. J. H. Sievers who, in February, 1899, won the highest award by the National Carnation Society at its show held in Philadelphia. Mr. Sievers' new seedling, which he named "Hannah Hobart," was in competition with and vanquished "Mrs. Lawson" for the full stock of which $30,000 had been paid the year before, when it was the winner of the highest award. The California flower had of course a serious handicap in distance, time and the risks of carriage. The flowers went by express. Fifty specimens were required by the rules. Each flower was placed in a separate glass tube. The tube was fastened into a tin case and filled with water. The water was not changed in transit nor for the exhibition. Mr. Sievers preferred to use the California water because he was afraid of a strange water and did not know how it might affect the flowers. The California flower scored 86 out of a possible 100 points and was declared a winner. "Mrs. Lawson" was thus beaten by a flower grown 3000 miles away. It was probably the most dramatic event of American floriculture and contributed much to the prestige of California. Fortunately enduring hatred was not engendered between these two pink beauties. They stand side by side in the lists of some California commercial propagators.

Soils.—Although carnations are worth growing on rather a heavy soil, and some kinds seem to prefer it, the rule is for light loams, even sandy, if not in a place where water stands and if the soil is made

amply rich by well-rotted manure, which will not only feed the plant but render the soil better fitted to hold onto water enough to make it thrifty. Though too much manure and water may induce too lush a growth and perhaps increase calyx-bursting, which is a capital crime in a carnation, one should never stint the plant with the idea of strengthening it.

A specific way to improve a sandy loam for carnations, which was followed for many years by an Alameda grower, is this: "Use at least one part of thoroughly decayed cow manure to five of soil, and add a sprinkling of bone meal, about one 5-inch pot full to a wheelbarrow load of soil. Where the soil has been manured for years one need not use as much manure, but add fresh builders' lime in about the same amount as bone meal. This is to cause everything in the soil that is foreign to decompose, and is especially good for soil that is too fat or rich. It also seems to prevent any green scum from forming on the surface. The soil should be thoroughly mixed by turning over the pile three times after the fertilizer has been added."

For carnations the soil should be well drained. Excessive rains during winter, following continuous irrigation during summer and fall, are very dangerous to carnations if the soil is not well drained.

Propagation.—The easiest and surest way to secure a limited number of new plants from an old one is by layering as described on page 70. The best time for this method is July and August in the cooler parts of the State, although it may be done successfully at almost any time in this climate and in warm places is most successful in the spring, while moisture is abundant. The layers will generally root in four or five weeks. The operation is simple: Select a stem with partly old and partly young wood; make a slit with a sharp knife at the base of the young wood upwards, extending through a joint or two, so as to form a tongue; peg down the layer rather firmly and add sufficient light, sandy soil to cover the incision to the depth of an inch or two, and keep the ground moist. When found, by removing the earth gently, that the layer has rooted, it is cut loose from the old plant and set out where desired to grow.

The propagation by cuttings is practiced generally. The cuttings are made of young wood, and long enough to have a firm base; insert them firmly in clean sand in a seed bed or in a seed box in a cold frame, shading with a cloth or lath cover. The cuttings may be made with a heel or cut just below a joint; they should be well watered after planting, but too much dampness must be avoided.

Carnation cuttings can be rooted any time from September to May with good success. They should be cut with a knife, as tearing damages the old plant. Three to four inches in length makes a good cutting. Some advise to split up the cutting about one-eighth of an inch,

giving more room to root. Carnations, after having been rooted, should be planted in light, loamy soil, well manured—not too much water, as they become rusty. The first flower stems which appear should be nipped off. This makes the plants more stocky. If you let them run up and bloom the result will be tall, spindling plants and they will not produce as many or as good flowers as when headed.

Carnation Seedlings.—Carnations from hybridized seed give good plants and if one buys the highest priced seed he is apt to get the produce of good selected plants, which makes the progeny far more interesting and desirable. Unless one is operating in a green house carnation seed seems to start best from February sowing, if the air is moist and warm, than earlier sowing. If the seed is sown in June in pots or boxes, fine, strong plants can be had by autumn and they will flower all through the next season.

The late F. A. Miller was a pioneer florist of San Francisco and a fond grower of seedling carnations. His advice to amateurs was as follows: "Most of the seed sold is not hybridized artificially, and in this case no great results can be obtained from that source. Carefully hybridized seed is too expensive to be retailed, and can only be bought by the 100 or 1000 seeds. Any one who has a collection of good carnations can readily produce seed, by proper hybridization, which will give excellent results in the production of new varieties, and, furthermore, it is one of the most fascinating pastimes any one can engage in. Looking at your flowers, you will find some showing the pistils very prominently; these are the pistillate or female parents. Then we find others flowers which show the stamens very conspicuously; these furnish the pollen with which the pistillate flowers are fertilized. The pollen will readily adhere to a fine, soft brush and is then applied to the pistillate parent of any other flower. If this operation is performed between flowers of a most contrasting color quite a variety may be obtained, and if the operation is performed between flowers of the same color, superior varieties of that color may be obtained."

More specific directions in the same line were given by Mr. C. J. Haettel, who grew carnations at Redondo Beach: "From 7 to 9 o'clock a. m., according to the amount of moisture in the air, the flowers will be ready to pick for the purpose of extracting the pollen, which should then be dry. I use a clean plate to receive it. The easiest way to extract it from the flowers is to turn the petals back and, with a sharp pair of scissors, cut the stamens off. After all is gathered, cover the plate with a clean pane of glass, and turn it over occasionally, as some moisture will collect on the glass. Under ordinary circumstances, the pollen will be ready to put away early in the afternoon. It is then put through a fine sieve and allowed to fall gently upon a clean sheet of paper, from which it is transferred to a

one-ounce bottle. When we are ready to hybridize, we make use of a pair of jeweler's pincers. With these we extract the stamens, early in the morning, before the flowers have been fertilized by insects or self-fertilized. A little later we pass with the pollen bottle and shake a little of it on the pistils when the operation is complete. The same method is employed in fertilization for seedlings of roses, gladioli, amaryllis, cannas, dahlias, etc. Use the best flowers for seedling purposes and retain only the best from which to propagate."

Care of Carnations.—The plants should be well watered in hot, dry weather, and if mulched with old manure, leaf-mold or grass to a depth of two inches will improve their growth. The buds also, when crowded, should be thinned out as in rose-bushes.

One of the worst enemies of carnations is the gopher, which must be killed if the plants are to be safe. As this is easier said than done, the amateur may want to know how to grow a few plants out of their reach. Choose a sunny place, if you are near the coast, and make a bed four feet wide and as long as you choose. Dig out the soil to the depth of 8 inches, the whole size of the bed. At the bottom lay a piece of galvanized wire netting (chicken wire) with a mesh not larger than 1 inch; then lay a border of 12-inch boards so that the bottom of the board rests on the chicken wire. This gives you a bed that is gopher proof and will last a long time and will more than pay for itself in the long run by preventing the gophers from taking your choice carnation plants, for it seems that they always take the choicest varieties. Fill this bed with the mixture of soil, lime and manure, mentioned above. Fill it heaping full, for it will settle 2 or 3 inches. Work over the soil two or three times before it is time to plant out the young plants, and work over and smooth well immediately before planting. The young plants should be planted direct from the cutting bed or sand into the prepared bed as soon as they have rooted strongly. Do not leave them in the sand until they begin to run up tall and spindling, or you will never have healthy plants.

The plants should be placed one foot apart each way, and should be headed out before they become thoroughly established to make them branch close to the ground. In planting out rooted cuttings from sand let the sand that adheres to the root remain.

Another back-yard carnation arrangement which may become very pleasing to look at is made in this way. Take an old barrel and saw it in two. Put the large end in the ground 2 or 3 inches, first having knocked out the top. Fill the half barrel up with old leaves, cow manure, and loam. Plant young plants out around the barrel, say 6 inches from the edge and about 10 inches apart. After the plants are thoroughly established, and are in a good growing state, give them a mulch of about one inch of thoroughly rotten manure. After this

whenever you want to water your plants turn the hose loose in the barrel. Dish water and water from washing clothes is good. The carnations will soon grow up and hide the barrel and all your neighbors will want to know how such monstrous carnations came about.

Supports for Carnations.—Carnations have a way of lopping all over the place and breaking when you try to raise them. It is better to tie to a small stake as they grow or to make a trellis of crossed strips, leaving openings through which they can grow and on which their sagging shoots may rest. But perhaps the best way to keep a carnation bed looking well is to be always pulling out old plants and putting in new ones which you can take from your propagating house or frame. Keep your best varieties always new by continually arranging for a succession of vigorous youngsters.

CHAPTER XVI.

THE CHRYSANTHEMUM.

The Californian enjoys marked advantages in the growth of the chrysanthemum, and can do much in the open air which has to be done with artificial heat under glass at the East and abroad. One can infer this much from the common sight of acres of chrysanthemums under a clear sky and not a sign of protection, unless the blooms are for special exhibition or commercial purposes. It is true that it is often desirable to rig up a sort of a fly of light cloth to protect the bloom from the excessive heat of the sun, which is occasionally strong enough late in the autumn to injure the purity and brilliance of the bloom, but protection, except from heat or dust is not thought of. Even the latest bloomers, which linger along until midwinter, do not find anything in the California winter temperature to disconcert them, but freely display their disheveled locks even amid storms, bending by their own weight and that of the entangled raindrops and cast about by the breeze until they seem like sea nymphs vainly endeavoring to shake their tresses free from the gems which Neptune has showered upon them. Charming even in such distress, and when the winter garden would be otherwise well-nigh bereft of beauty, the chrysanthemum brings its marvelous forms and wealth of colors to make even the short, dark days delightful.

But it is the midseason varieties, of course, which carry the greatest weight of glory. In November the season is at its height, and then there is seldom rain enough to disarrange a bloom or drive an admirer to shelter. The heat and glare of midsummer are over, the winds are resting for later exertions, and amid the most delightful surroundings of warmth and quiet the queen of autumn displays her marvelous charms.

This exceptional adaptation of the autumn and early winter climate of California to the growth of the chrysanthemum led Californians to enlist most zealously in its service about twenty years ago when the 'mum was the ruling goddess of the floral world. Though its reign was short at the East, because its blooming season made it practically a greenhouse flower, in California its enjoyment of the open air ensures permanent popularity. Its culture requirements are so few to secure garden plants of satisfactory quality, the arts by which the finest show blooms are obtained are so simple, and the extreme ease with which the plant is multiplied and disseminated, the magnificent mass effects it produces in decoration—all these are elements of popularity which will hold for the chrysanthemum a high place in public favor in California.

Chrysanthemums From the Seed.—When the flower was at the height of fashion at the East and propagators were athirst to get striking new forms and colors for exhibition and trade, the fact was demonstrated, which from knowledge of the climate could have been easily implied, that California had marked advantages in the production of the seed and in the growth of seedlings. The demonstration came at the Madison Avenue Flower Show in New York in 1892. In its report of this display, the publication entitled "Gardening," introduced the decision of one of the best-known New York growers in these words: "My greatest surprise this year was the California seedlings. I tried only a few of them this year, for to tell you the truth, in face of what we have in the East I did not think we could get much, if anything better, or as good, from California. But see what I've got! Aren't they beauties? Rest assured I will send for every seedling they send out in California this season." These seedlings were so notable that "Gardening" gave engravings of eight of them. But California did not follow up its lead in propagation and these varieties disappeared.

There remains from this experience the practical assurance that the growing of seedling chrysanthemums promises satisfaction to the amateur at least and that it is very easy to grow them. In fact they are apt to volunteer freely. At one of the San Francisco flower shows there was a very interesting exhibit of volunteer seedlings from a garden near Haywards in which the offspring was shown in connection with the bloom from the parent plants. But, of course, seed from the common plants is likely to give something worse than its parentage, and selected plants hybridized toward some particular characters foreseen to be desirable, by taking pollen also from selected plants, constitute a proper basis for operations in seed production. The method is, in general, similar to that given for carnations in the last chapter. One can buy, however, from the best seedsmen, seed taken from the best florists' flowers and thus take a simple step toward novelties, if his curiosity leads him that way. The seeds should be handled according to the suggestions on growing plants from seed and transplanting in Chapter VII.

GROWING CHRYSANTHEMUMS FROM CUTTINGS.

Growth from cuttings is the universal way because the plant responds so loyally to the objects in view and because one escapes undesirable variations. There are very many ways of growing and handling cuttings—each of them leading toward definite and very different results.

Chrysanthemum plants are sometimes left to take care of themselves in some out-of-the-way place in the garden, new plants being made by merely dividing the tangled mass of roots when the spring spading

is done. This is better than leaving the old plants to renew themselves by new shoots from the old clumps, and will give better flowers of a size suitable enough for every-day house decoration, if the colors are good.

Another way is to take shoots of the previous fall growth and handle them as hard wood cuttings according to methods described in Chapter VIII. This also gives fair garden plants which may serve a good purpose.

But the way to get the greatest flowers is to work with soft wood cuttings made from the new spring growth, rejecting all old roots and old wood and keep this soft wood always going, by never allowing the cutting to wilt and starting it to making new growth as soon as possible and keeping the wood soft and active until the bloom is cut. This of course involves most constant feeding and watering of the plants as will be noted later.

As the soft wood is to be used the cuttings are taken later than when root-division or hard wood cuttings are relied upon. Such cuttings may be taken during the whole of April, May and June—the later dates in places with cool summers. A day or two before taking the cuttings it is well to water the old plants well if showers have not done it. This is to make them as full of moisture as possible and the cuttings will root better. If the plants have thrown up lots of suckers from around the old plant, you can take the tips. But two-eye or even single-eye cuttings (if you are short of wood) will do well. The two-eye cuttings are made by cutting slantingly just above an eye or joint and just below an eye, making a slanting cut. Use a very sharp knife. Single-eye cuttings can be made by cutting just above an eye and leaving about an inch of stem below the eye. They will root in about four weeks.

But tip or top cuttings are usually best if one has plenty of shoots to take them from. There are at least two ways to handle them: One to root them in a cold frame, the other to set them at once where they are to grow.

Mrs. S. G. Wills of San Jose advises the former in these words: "At some favorable time in March, April, or early May—April is best—break (not cut) slips from the tops of the suckers, which come from the old plants, and pinch from the slips all the leaves, except the bunch at the end. Let these slips stand in water for twenty-four hours and they will absorb enough moisture to keep them from wilting when they are set out; then plant them in sand in boxes to a depth of about six inches, planting them about two inches deep. Place these boxes in a sunny exposure and up from the ground, cover the boxes with painted or shaded glass, allowing a good circulation of air between the box and the glass, so that the slips will not be too much heated. These

slips will take root in from two to four weeks if kept wet; the sand should never be allowed to dry out."

Mr. J. Seulberger of Oakland prescribes the other method, viz.: "In making the cutting, take the top of a fresh stock, such as sprouts from the old stock, early in the spring, and allow a cutting long enough to contain about six eyes, three to be placed under the ground and three to remain above. The best way is to put these cuttings where they are to stay, so as to avoid transplantation. Chrysanthemums are the easiest of all plants to root from cuttings, and so the beginning of the amateur's work is made easy. Put the cuttings out in rows, about 12 inches apart, with 6 inches interval between the different cuttings. To divide the old plants or use root growths gives plants which do not produce good flowers. The sappy tops make the quickest growth and the most productive plants."

With reference to Mrs. Wills' advice to break rather than cut, we consider it useful for the sake of determining if the shoot is really soft and "snappy," see Chapter VIII. Mr. Seulberger's specification of such close planting has in view the training of the plant to a single stem bearing one flower. For common garden desirability we would give the plants greater intervals and allow them to make more stems—still, however, limiting them considerably.

TRAINING CHRYSANTHEMUMS.

The chrysanthemum is more systematically curbed and trained than any other plant which is grown for one season's service. It is naturally very floriferous and will keep rushing out new shoots and developing flower-buds on them until in three or four months it has assumed the aspect of a large flowering shrub. But it will accept training to a single stem with several good branches or blooms—even to the extreme of growing one thick stem, three or four feet high, and producing one globular bloom as large as one's head, and it will cover that with a wig of flowing locks or of ringlets, if you choose those kinds. This writer has never done that and so he invites Mrs. Wills of San Jose to make the toilet for the queen of autumn flowers:

"When the plants are well rooted in the sand transplant them with care into mellow soil and shade them from the direct sun for a few days. The plants must not remain long in sand after they are rooted, as they will be weakened.

Dis-Branching.—"The plants will begin growing in about ten days after setting out. When they are from eight to ten inches high and have put forth at least two pairs of leaves, pinch out the terminal leaf bud. In a short time a branch will start at the axil of each leaf. Break off all these branches except two or three nearest the top. When these branches have made a growth of five or six inches and have put forth

at least two pair of strong leaves, pinch out the terminal leaf bud from each branch. Branches will, as before, start from each auxiliary bud. They must likewise be broken off, saving one or two on each branch. This topping process should be repeated several times, managing so that the last time shall be during the first half of July. Be careful not to have too many branches, from three to six at last topping. If you have been timely and judicious in your topping your plant will be about twenty inches at this last topping. Let the laterals that come after this topping grow from two to four inches in length, and then do your last breaking out of branches. Leave none but strong ones, and from three to six to the plant. You are now deciding the number of flowers you are to raise to the plant, and branches must guide you.

Dis-Budding.—"You have now broken off your last branches late in July, and your plants now begin their vigorous growth. The strong branches will soon run up from three to four feet high. During this vigorous growing buds will begin to appear in leaf axils. From this time on success is only to the vigilant. None of these side buds must be allowed to grow. Each branch will indicate its determined stature by presenting at its terminal a bunch of flowers and leaf buds. We are now at the point where skill and knowledge are most needed, as well as the greatest vigilance. A little neglect at this point and you fail in your accomplishment, you will have a large number of flowers, but they will not belong to class A.

"When the little buds that appear in a cluster at the very end of the lusty branch have grown to about half the size of a pea, all of them but one vigorous flower bud must be broken out. How are you to know the flower buds? If but three are there it will be the center one. You are likely to know it from its appearance. Those green leaf-like parts that are to form the sepals of the flower are longer and more pointed than those on the leaf bud. Much care must be taken in this dis-budding. The stems to these buds are very brittle and break very easily. Hold these buds with one hand and take a stick like a toothpick and crowd off the buds which you wish to dispose of. You will make some mistakes here. If you should leave a leaf bud instead of a flower bud all is not lost. The leaf bud will make a branch which will in a short time present a terminal cluster like the one with which you have just dealt; then try again. This breaking out of buds must not be neglected for a few days, but must be attended to at the proper time."

Crown-Buds or Laterals.—A question which has always been at issue between chrysanthemum trainers is whether a crown or a lateral bud produces the better flower. Mr. Howard of Los Angeles has, according to our observation, the right of it when he says: "As soon as buds are large enough to handle, say about the size of a pea, select

one of the strongest on each of the shoots and remove the rest. It is not always advisable to leave the large one at the terminus of the shoot; this often brings a coarse bloom and too early. A second bud lower down, although of smaller size, will produce an equally large bloom, better finished, equal as to size, but somewhat later in the season. After the bud has been selected keep all side growths pinched out, the idea being to divert the entire flow of sap to one bud on each shoot."

AN EASIER WAY WITH CHRYSANTHEMUMS.

As there will probably be amateurs who wish to have chrysanthemums but cannot rise to the intensity of the foregoing, it will be proper to indicate an easier way which will give inferior but still gratifying flowers. It consists in working with the old roots with treatment fitted to revive and re-stimulate them. Allow strong plants, after flowering to retain their place until the following January or February, because, not having strong, far-reaching roots, but netty, fibrous roots, they have exhausted the soil. This is very difficult to replace even by giving them a heavy top dressing; therefore, take them up, cut away the old stems and save only strong single shoots. Unless the soil is very good, remove it and put in new soil to the depth of one foot, using one part manure to three parts of loam. Tread the soil firmly around the plant, and when fairly started water well.

Of the shoots which spring from the base of each plant, select four of the large flowering variety and six of the small and single ones, removing all the others. Stake when high enough to need support, spreading them outward to give as much sun and air as possible. Do not top the branches, as they grow best by allowing the shoots to break naturally, selecting two of the strongest on each stem and removing the others. When large flowers are required, allow three stems on the plant to produce a single bud each. This is done by removing all the side growths as fast as they appear upon the stems.

When the production of a quantity of flowers is the main object, top the plants when six inches high and continue doing so until the end of June; or let them grow along to the latter part of June, and then cut back to within six inches of the ground, and after that allow them to grow away at will, being careful to remove suckers.

FEEDING THE CHRYSANTHEMUM.

Though the chrysanthemum will do something on any soil, it will only be great, either in bush or in single blooms, when fed most generously on a soil best suited to root-action, as described in Chapter III. Hints for autumn months, Chapter XII, are constantly repeated for sake of emphasis upon their indispensability. To forget them is to fail to get all the plant can do for the grower. There are several

practical suggestions concerning the feeding and care of the chrysanthemum during the building of bloom, which may be helpful.

Perhaps no plant will show neglect more plainly than the chrysanthemum, and one or two weeks of neglect will finish them. That is, they will not make large, perfect flowers, even if you keep up a good treatment afterwards. If you let the plants dry out at the root they become hard-wooded and inferior flowers are the consequence. During the early period of growth the plants should not be kept too wet, yet never let the roots get dry. After the last topping water copiously. It is well to wash with the sprinkler the dust from the leaves about once a week; do this at the close of the day. Adobe soil will not stand so much watering as loamy soil. Judgment must, of course, be used.

All plants should be carefully staked and securely tied in several places so that there is no danger of stems being broken by the wind or otherwise. Builders' lath may be used, or "shakes" split into narrow strips answer very well. The plants look neater if not tied with twine or strips of cloth. Strings of rafia, or a strip of New Zealand flax, or of dracaena leaf, as described in Chapter XI, are very satisfactory.

Water freely, and occasionally with liquid manure, which may be made in this way: In a large tub or cistern, place one bushel of soot, tied securely in a thin bag, and one barrelful each of fresh cow and horse manure; fill with soft water. Dilute to the color of weak tea. Occasionally give them a change of weak poultry-manure water. Artificial fertilization should be kept up at intervals of a week and stopped only when the first buds begin to show color. After this stage no fertilization is required; in fact, is injurious, but the water supply must be frequent and copious.

Nitrate of soda, as described on page 33, is available. Sulphate of ammonia is also used—commencing at a quarter of an ounce and increasing to half an ounce to a gallon of water, is safe, and may be given twice a week, or three times to extra-strong plants. This is the cleanest and least offensive process of manuring the plants.

After the Battle.—When the chrysanthemum has done flowering, leave the plant in the place where it grew until spring, to furnish you with slips for next years's growth. After you have taken all the slips you want, dig up the old plant and throw it away, for it is of no further value.

CHAPTER XVII.

OPEN-AIR HERBACEOUS PLANTS.

The climate of California disturbs all classifications of soft-tissued plants which satisfactorily group them in wintry climates. We cannot consider these plants as annuals, biennials or perennials, because they will not act that way under our climatic conditions. It has already been suggested in Chapter II that many hard-tissued plants, like trees, shrubs and vines, seem to be always trying to move themselves from the deciduous to the evergreen class and analogous behavior is found in the shiftiness of soft-tissued plants—some annuals holding over and repeating their bloom in a second or even a later year; some biennials blooming in the first year and holding over more or less toward the perennial class and some perennials, not only living indefinitely, but being active both summer and winter and even assuming something of woody tissue, which no well-behaved herbaceous plant should ever do. It seems, therefore, that the various groupings: annual, biennial, perennial, deciduous, evergreen, etc., are really classifications of places not of plants, and we get them out of our way by shipping the whole bunch to the geographer. The flower-grower in California has very little use for them. If, however, he is of enquiring mind, he will find food for thought in the writings of the California botanists named on page 8. The study is of the individual plant and what it will do and will not do and not of a class into which some chilly climate has forced it. Therefore we place all herbaceous plants in one group and indicate their behavior, so far as we have observed it, in connection with the mention of each. The distant reader in a wintry climate can learn more of the California attitude of plants by studying the behavior of plants in greenhouses than their behavior in the open air. When he comes to California and sees the mignonette living and blooming all through the frost and even when the soil is too wet with January rains to permit of much outdoor work, it becomes so rich in fragrance, so fresh and daintily green, that one must conclude to allow it to be a biennial or perennial as it lists in defiance to all rules.

Good to Begin With.—Undoubtedly the most glorious display of floral form and color can be secured for less money and in less time by sowing herbaceous plants in variety than in any other way. Although the best development of the plant and endurance of bloom is to be secured by following the suggestions for soil, seed-planting and we would not lighten at all the emphasis therein, it is also true that the reason for the beginner's preference for annuals, lies in the fact that everybody can grow them; that they absolutely require

PLATE 8: "SWEET PEAS LOVE A FENCE OR LOW SHED"—PAGE 181.

in the fact that everybody can grow them; that they absolutely require neither glass, flower-pots, compost, sticks nor shades, and in California places with well distributed rainfall, not even watering. Of course these accessories add to the beauty and length of life of a plant, as just suggested, but for those who have no desire to go to much trouble or expense, there is a fertile field in the cultivation of herbaceous plants, as they yield abundant satisfaction for a minimum of labor. Then, another consideration is their cheapness; it is simply marvelous to see how much can be grown from a dollar's worth of seeds and what an endless amount of pleasure will be found in the truly beautiful display. In a very few weeks a wild waste can be transformed into carpets of flowers.

But though the beginner is urged to take to these plants for joy and floral education, it must be admitted that, after awhile, many will grow indifferent, even in some cases going so far as to call them weedy and short-lived things. So they are, many of them, while others again cannot be surpassed by any other class in delicacy of beauty, and none can be found that will give such liberal returns in gay display of color, also in the great variety of both character and color.

Hints for Open Sowing.—If you are on a hurry-up job, you need only break up the soil with plow or spade, rake down decently and sow the seeds—covering less or more, according to the size of it, as suggested in Chapter VII.

It is not usually desirable to sow the seeds in lines or rows for ease of cultivation as you should garden vegetables or flowers grown specially for cut blooms. It produces a much better effect to have the different flowers in groups or patches and arranging these according to the stature of the plant and its colors which are indicated upon the seedman's packet enclosing the seed, as will be mentioned below. An Oakland grower gives these pertinent suggestions for defining and placing the different clumps or patches:

"Get some long strips of thin wood which will bend into an oval hoop. Make several different sizes, as the larger-growing plants will want more room than the smaller ones. Take the hoop and press down on the soil so that a mark will be left, inside of which sow the seeds. Leave a space between the clumps, if possible, equivalent to the width of the hoop.

"After the plants are up, do not leave them in a crowded state. Thin them out ruthlessly to about six inches apart for the small-growing plants and nine inches for the stronger-growing annuals. It will pay to do this. It looks like waste, but the final results are better."

If the spaces between the clumps are kept smooth and clear they heighten the effect and afford room also to walk or work among the plants.

Arrangements for Stature or Size.—The arrangement of the groups in relation to each other, with such wide interspacing as has been commended, or the sowing of small patches in a large composite bed, should always have regard to the height and spread of the bloom intended. It need only be mentioned that, however successful a flower bed might be in other respects, if through ignorance or carelessness the dwarf varieties were planted in the center, and the tall ones at the circumference, the effect would be ridiculous. This, of course, is true of all bedding plants, but in sowing the seed in the beds in which they are to flower, it is much more likely to be overlooked than in that of summer bedders which are planted out from the pots or from seed boxes.

Arrangement for Color Effects.—A very good suggestion on this point was given some time ago by Mr. Franklyn, formerly of Los Angeles: "When colors are planted separately, and intended to form a design however simple, always plant the individual colors in sufficiently large masses, especially when the plants are inclined to be tall, the stems weak and the flower heads large. Otherwise the bed is liable to become a mixed one. Take for instance, the larger varieties of Phlox, planted in narrow concentric circles. The weight of the blooms will cause the stems to decline from the perpendicular; when the pink will become mixed with the scarlet, the white with the purple, and the whole be hopelessly blurred; while if the zones were wider, though the continuous edges might become more or less intermixed, the general effect would be preserved. In arranging for color effects, use solid colors. Flowers with spots, stripes, etc., are often very pleasing when we have time to examine them individually; but as effective bedding plants they are often a failure. What can be richer than a mass of nearly black flowers brought into contrast with golden or yellow; or what more chaste and pretty than a sky-blue in company with a pure white?"

Coincidence of Bloom.—Mr. Franklyn continues: "Perhaps the most important of these considerations is the one which relates to a simultaneousness of flowering. Nothing can be more exasperating, after having planned a gorgeous effect, than to see it produced in installments, one part beginning to flower after another has ripened its seed. In order to avoid such a calamity, it is advisable to plant in the same bed, or group of beds, different species of the same genus only, or, better still, different varieties of the same species. In the latter case at any rate they will be sure to flower simultaneously. It is obvious from the above remarks, that in producing the best results with annuals, a previous acquaintance with them is very helpful."

It is, of course, impossible for a beginner to reach the highest effects in handling herbaceous bedding plants, but suggestions of points to aim at are none the less helpful and inspiring. One must, of course, know plants and must be patient in studying them and discerning their relation to desirable mass-effects. He must not expect to produce a masterpiece by a recipe. Even in cookery, deliciousness comes not so much from the recipe as from knowing how to use it.

When to Start These Plants.—But, though some of the things just mentioned belong to the higher art of the amateur which must be attained by effort, there is one thing which a beginner can strike aright from the first, and that is starting early and keeping right at it in growing herbaceous plants in this favoring climate. Read again the references to the double springtime of California on pages 96 and 107—in fact, the suggestions for work in all the months in Chapter XII. One ought then to be convinced that the time to start plants, except a few tender ones, is during the autumn and winter and not in the springtime of wintry climates. Remember that the longer time the plants grow and spread before flowering, the finer will be the flower. One great secret in securing fine blooms is to encourage each separate plant to make as much growth as possible before it begins to flower. Late-sown seeds are hurried into blossom by the increasing heat before a good-sized plant is formed, and are not therefore so satisfactory. There is no fear of cold weather affecting the seed sown early, for seeds of nearly all kinds remain dormant and unhurt all winter until the genial sun calls them to life and action, unless it be in the cold mud of a heavy, ill-drained soil. California nature indicates the true California way through early starting. It is a common observation that self-grown coreopsis, sweet pea, godetia, nasturtium, eschscholtzia, dianthus, larkspurs, corn flower, nemophila, etc., are found in the walks and corners, having started with the fall rains and, unless they will not endure a light frost, establish themselves like weeds. When an unusually fine plant appears, it is sometimes transferred to a border where it can have soil, and will amply reward by the vigorous strength of the plant and beauty of the flowers, the gift of an early start.

But though it is easier to start seeds early in the rainy season and get bloom during the continuation of it and during reasonable extensions into the summer beyond it, it is also possible to start again near the end of the rainy season with the same plants and have late summer and autumn bloom from them. This requires greater effort in handling the seed and the young plants. It is amply set forth in Chapters VII and XII.

Cultivation and Care.—All these plants have been mentioned as easy to grow if one makes the proper seasonal start and as requiring less care than most other plants, still it must be insisted that the quality and duration of bloom depend largely on the cultivation. For instance, according to Shirley Hibbard, one plant of Virginia stock, allowed to attain complete development, will cover more than a square foot of surface, lasting in blossom two months, while twenty in the same space will be spindling with flowers all over within three weeks at the utmost. Then by carefully removing all seedpods the moment the flowers wither, the blossoming season may be prolonged almost indefinitely. Sweet peas thus cared for may be in bloom nearly a year, if moisture is available. By bestowing care and attention, a plant may be kept in blossom for a long season, giving double the number that would be given if left to themselves.

All this, however, is more or less dependent upon giving the plants plenty of room. Always remember to thin out seedlings to ample spacing and to give space when transplanting. Over-crowding the plants destroys all rules for satisfaction with them.

Exposure.—Sun and shade are relative terms; for instance, full sunshine on the coast may sometimes be cooler than shade in the interior. For this reason one has to read prescriptions of sun and shade for different plants, with some reference to his local conditions thereof. Still there are some distinctions which may be widely true, but realized in different places at different times. Many plants which enjoy full summer sunshine near the coast, resent its heat in the interior, but do enjoy the interior winter sunshine. It is a very simple deduction, then, that summer growth of many herbaceous plants in the hot valleys must be undertaken in partially shaded places, while in cooler situations they may need contrivances for concentrating sun heat in the place they occupy. These are things one has to learn by local experience or observation.

HERBACEOUS PLANTS CHIEFLY COMMENDED IN CALIFORNIA

The proper way for the amateur to arrive at a conclusion as to which herbaceous plants he should grow in his place and for his own taste, is to try all of which the seed is offered by the seedsmen. They do not list a seed unless it is good somewhere and meets the taste of a good many people—therefore the catalogues should be secured each year and carefully studied. It is not advised, of course, that the amateur plant all their offering at once; take a dozen or a score at a time and in that way work down the list until you get enough to occupy your available space or to fill your heart with joy all through the year. Watch the habit of the plant under your condi-

tions; whether it is thrifty and contented or not; how beautiful its foliage is; how its bloom meets your notion of desirability; how it fits into your color scheme and what place it will take in the sucession of bloom which you should always work for or you will not get all the climate has for you.

But we know the reader will not be content to have us push him off to the catalogues, so we have made a list from our own experience and observation and from our notebooks and can name the following as the open-air herbaceous plants which are actually most favored by California amateur growers:

Ageratum
Alyssum
Asters
Browallia
Calceolaria
Calliopsis or Coreopsis
Campanula
Candytuft
Centaurea
Chrysanthemum (Annual)
Cineraria
Clarkia
Columbine
Cosmos
Daisies
Euchardium
Flax (scarlet)
Forget-Me-Nots
Foxglove
Gaillardia
Godetia
Gypsophila
Hollyhock
Larkspur
Lobelia
Lupin
Lychnis
Marigolds
Mignonette
Nasturtium
Pansy
Penstemon
Petunia
Phlox
Pinks
Poppies
Portulacca
Pyrethrum
Rudbeckia
Salvia
Salpiglossis
Scabiosa
Schizanthus
Sweet Pea
Snapdragon
Stocks
Sweet William
Sunflower
Verbena
Violet
Wallflower
Zinnia

The foregoing is not intended to indicate that these are the best plants of their class. It simply means that these are approved by many people and invites you to find better if you can by trying others of which the seed is just as easily obtained. The list is restricted to those of more or less upright growth-habit; herbaceous vines will be mentioned in another connection.

And now it is fitting to remark briefly upon each of the plants, or groups of plants, indicated above, noting culture methods when

they are not fully covered by the detailed suggestions presented in Chapters VII and VIII:

Ageratum.—This trim, bushy plant, easy to grow all the year in California, is chiefly notable for its excellent shades of blue, from light to deep in different varieties, though there are white ones. Dwarf kinds are less than a foot in height and a mass of bloom; good for edging and bedding effects.

Alyssum.—Another low plant of continuous bloom is alyssum. It is chiefly useful for its white effect, though it comes also in yellows. We have wearied of it because it volunteers as freely as a weed. It comes from the seed most carelessly sown and it can be grown also from cuttings of the side shoots, but the fact never impressed us because we had so much trouble keeping the seedlings where we desired to have them. They seemed to enjoy growing as well in a gravel walk as in a bed.

Asters.—Asters are grandly available for bloom all through the summer and autumn from plants started in seed boxes under frames, beginning in January and continuing until May. This program will give blooming plants from May until October or later. If one does not desire to use protection appliances, a start can be made in April or May by sowing the seed in a small bed in the open ground and covered over one-quarter, or one-eighth of an inch. Cover with a light mulch and the plants should make their appearance in seven or eight days and be ready for transplanting into the permanent bed in five or six weeks. Some growers claim this method gives better results than planting seed in boxes, but the latter method seems more rational and is relied upon by most growers. The aster is a popular commercial flower and a great variety of forms, sizes and colors are available. Excellent bedding effects can be had with asters suitably arranged. We have seen this, for instance, very effectively worked out, in a large circular bed, by planting in the center of the bed a tall quilled variety in one distinct color, next the peony perfection in another distinct color, following with the cocardeau and dwarf chrysanthemum, the former having white centers and colored margins; and edging with the pretty little bouquet aster.

During recent years the aster has been grandly developed as a large plant to grow in singles or in clumps. A writer for the California Cultivator notes this: "The new varieties of the giant comet branching type and the upright branching add greatly to the list of desirable sorts. Giant comet is a loose, chrysanthemum, recurved petaled variety, while the upright branching is identical in form of flower with the old American branching type, having very large flowers of a branching habit but with thick, heavy stems which grow erect and are not easily beaten down by rain or sprinkling. For the amateur

this is probably the finest aster grown. The flowers average four to five inches across and there are five or six distinct shades. As a commercial flower it is unsurpassed.

Browallia.—This is also given to blues, shading from sky blue to ultramarine, in other varieties, from sky blue to white. It blooms very freely and grows from a foot upwards. It is less hardy than many others in face of frost and has to be handled with a little circumspection.

Calceolaria.—The small-growing hybrid calceolarias of shades from lemon yellow to brown, have recently become very popular for outdoor growth and produce gorgeous effects during the frost-free period. They bloom continually from May to November, and almost the entire year in some places, making large, almost shrub-like plants and lose only their top growth by light frosts. Although they may be crowded for mass-effects, we enjoy more the aspect of a single plant which has room for the branching it delights in. The plants are grown from the seed—preferably in hot bed or frame during the winter for spring planting out. The seed is very small and has to be handled as suggested for such seeds in Chapter VII.

Calliopsis or Coreopsis.—For rich yellows, shading to browns and maroons, the calliopsis species are notable. The most popular and serviceable species coreopsis lanceolata has flowers bright yellow, two or three inches in diameter, on long stems, one to three feet high; very desirable for cutting; blooms in great profusion during the whole summer and autumn. The flowers are very durable in decoration and success in handling the plant lies in cutting them very freely near to the ground. When this is done the plant continues to shoot them. If one tries to trellis or stake or otherwise support the blooms he gets into a tangle of new and old which is discouraging. The plant continues to make its flat foliage and to bloom profusely for years. It is readily grown from the seed by ordinary methods.

Campanula.—Campanulas are delightful for low foliage and graceful, long-season blue bloom. The old "Canterbury Bells" is much less desirable than the perennial varieties, though very showy for a short time. The perennials have much more grace in their open bells, carried on long stems. The genus campanula is somewhat baffling, as it includes nearly two hundred species, but of these only half a dozen are grown in California and of these the Carpathian is most popular for small gardens, at least while the tall pyramidalis and persicifolia are also very fine—the former shooting foliage and bloom as high as the fence and serviceable for screening. The plants are almost continually active if well cared for, and they are grown easily from the seed.

Candytuft.—Candytuft is one of the easiest of plants to grow and among the quickest to break into bloom and to furnish a succession by sowing at different dates. The different varieties differ widely in stature and in colors, and the beginner will find them excellent teachers of many elements of garden wisdom and they will encourage him to keep at it.

Centaurea.—Although the "Corn flowers" enjoy California gardens immensely, it is fortunate that, so far as we have observed, they are not disposed to become such a combined field beauty and pest as they do in Europe. The rich blue varieties are most popular. Centaurea also includes the "Sweet Sultans," of which there are several good varieties, with a wide range of colors, most of them bearing rich flowers on tall, stiff stems; excellent for decorative purposes. To get a long blooming season the plants should be started during the winter under protection and planted out early.

Chrysanthemum.—These are not the plants to which Chapter XVI is devoted, though botanical brothers. These are more herbaceous in growth and of shorter life—being classed as annuals. These plants, of which varieties are being developed which are likely to rival the assortment of the perennial chrysanthemum, are rapidly growing in favor and are serving striking purposes in enriching midsummer and autumn bloom. The plants are grown under cover and much as asters are and are easy to handle in every way.

Cineraria.—The open-air glory of this plant during the winter growth and bloom, followed by spring and early-summer abundance thereof, is each year attracting more attention in California. It is still, of course, a hot house plant, starting in August for winter bloom, but it is greater through self-sown plants appearing in masses after the autumn rains begin, in places where older plants have bloomed the previous summer. In fact, the cineraria presents the invertion of horticultural practice in California more strikingly, perhaps, than any other plant, for instead of taking house-grown cinerarias to the open ground for blooming, open-air volunteering, or selfsown, plants are sometimes potted up for house growth and the writer was quite flattered once by a request from a local florist that he be allowed to take up from his garden a chunk of earth which was fairly green with tiny cineraria seedlings just right for pricking out in thumb-pots. The seed is exceedingly small and nature had done surface-sowing which brought myriads of seedlings when the heat and moisture of October in the coast region were just right for germination. But if one has not a supply of such seedlings or if he desires to buy selected seed, let him follow the suggestions for the finest seedlings in Chapter VII. The cineraria in the open air in California enjoys shade even in the coast district. Where soil and

moisture are kept right the plants can be grandly grown under trees, which do not branch too near the ground, or on the east and north sides of buildings, fences, etc. Plate 11 gives a view of a tall phoenix palm taken in December. This tree holds its umbrella-like top over a circular bed of cinerarias of mixed colors which attracts the attention of all passers. In December the new self-sown seedlings are coming on well and there is a scattering bloom on a few old plants which does not deeply impress the camera. But from February until June the bed will be gorgeous, and then there will be poorer bloom until the old tops are cleared away in September. Soon after, new growth will appear from the old roots and seedlings will spring up freely as above described. The cineraria surely does like to be a Californian.

Clarkia.—Clarkia is a Pacific Coast flower which seems almost to be better known at a distance, where it has been encouraged into variations, than at home, although it is popular in California—especially in the southern part of the state. Its culture is very simple and its bloom fine. It should be sown here in the autumn or at intervals during the rainy season, instead of being held for spring planting as at the East. Clarkias grow and bloom well in moist soil, bearing flowers showy of peculiar form, freely and continually produced.

Columbine.—Columbines are available in various heights and several colors. They are easily grown if given partial shade and in good situations have long life. Eastern and northern openings give them superior summer activity and appearance, although in the coast region they are very interesting and satisfactory in various exposures, if not too far neglected.

Cosmos.—Cosmos is one of our grandest summer and autumn flowers—the frost-free period being long enough to enable it to grow almost to the stature and form of a tree if given plenty of moisture during the dry season. It is, however, a plant which must be counted tender against frost, and is therefore grown from seed sown under cover and transplanted. The improvement of Cosmos is in part to be credited to California and it is interesting to read what the late Mrs. Theodosia B. Shepherd of Ventura wrote some years ago about the plant with which she worked very successfully:

"To be thoroughly appreciated, cosmos should be grown in large quantities, in masses, in groups, in lines, as single specimens, in order that it may be seen in all its phases. A single specimen plant often covers a space of 10 or 12 feet in diameter, and is adorned with blossoms from the ground up.

"If planted about the first of May, the plant grows very tall, and the stems frequently measure an inch and a quarter in diameter, the

branches five or six feet in length. If planted late it grows about three or four feet high, and comes into bloom the same time as that which was planted early; the flowers are just as large and the plants more easy to manage when not so tall. When planted in the late fall it comes into bloom when the plants are about one foot high, and the flowers are small.

"There are white and pink flowers with full, round petals, slightly incurved, very large, resembling camellias, pink and white frilled ones, with very large, broad petals with edges fringed; these resemble romneya coulteri or California tree poppy; flowers in pink, white and mauve, with plain round petals and large, flat eye, having a waxen appearance and yet much resembling Anemone Japonica, in large and small sizes, the larger ones having broad-plaited peals; flowers with a maroon ring around the eye; large pink and white star-like flowers; charming crimson flowers of infinite variety of shape, measuring four and five inches across; white flowers with a delicate mauve ring around the eye. Indeed, there are so many beautiful combinations of shapes, shades and colors that I cannot find language to properly describe them."

Cosmos plants can be started under cover, or somewhat later, may be sown in the open ground. The plant is easily grown, the essential being to give the plants room enough. It is not best to force to extreme size unless one wishes a screen of beautiful foliage and securely stakes the plants. Our greatest achievement for size was blown flat one year by the first autumn rainstorm.

Daisies.—The term "daisy" is hardly descriptive of anything, but it is still in use as a popular name. The old English daisy, (Bellis) the low-growing rosette, will grow freely in California with any sort of planting and, lacking that will plant itself. It is still favored in small gardens for an edging, although it has no idea of staying in that form. Some of the asters are also "daisies," and they have the aster habit, as already indicated. The most useful "daisies" in California at the present time are those of chrysanthemum ancestry, produced by Mr. Luther Burbank. They are exceedingly satisfactory to the amateur, as they are easily grown from seed or by division of the roots and they will endure much neglect, although, of course, the full size of bloom, which is about four inches indiameter, is only to be had by giving the plant room and light and plenty of water in the dry season. Still maximum size is not essential and unless one's garden lies in the lines of soot-blows he will get grand, glistening-white blooms in great profusion on long, strong stems, which enable the decorator to dispose the blossom very gracefully and effectively. Mr. Burbank's Shasta daisy group has to some extent displaced the old "marguerite"—the woody chrysanthemum species

which one is apt, unreasonably, to expect to keep always good without renewal of wood. Other herbaceous "daisies" of Europe have been displaced by the Shasta group.

Quite a different and a newer "daisy" is called the "Transvaal" or "South African scarlet daisy"—Gerbera Jamesonii, which is receiving some attention in Southern California. Prof. R. T. Stevens of the University of California furnishes the following note: "The Gerbera is not an easy plant to raise, requiring a warm, sunny, protected place on a slope, if possible, for it will freeze easily. Good rich soil and good drainage are essential. The greatest care must be taken to prevent the crown of the plant from being covered with earth or with litter, or it is likely to damp off. The base or crown should be even a little above the surrounding ground. The plant demands water, but the drainage must be such that none of it will settle and remain to create wet, soggy conditions. The plant is often grown on small, raised, hillocks from eight to twelve inches above the surrounding ground, with a basin of water at the top."

A much easier plant is like a daisy and is called the African orange daisy, (Dimorphotheca aurantiaca) excellent for borders or low edging, as it keeps below a foot high and covers itself with bloom. The plant is hardy as a weed; come from seed with perfect success and is easy to transplant. They should be given six or eight inches apart in the row. They will flower from two and half months after planting until winter and in mild winters will bloom through the whole season.

Euchardium.—This is a plant which should be more widely known. Its full name is Eucharidium grandiflora, and a grower gives this note: "In the size and form of the flower it very much resembles the Clarkia, than which it is dwarfer and more compact, and is more acceptable as a bedding plant. The habit is all that could be desired, and the flowers are attractive, not only for beauty, but for the curious appearance presented by them, possessing as they do the peculiar tri-lobate petals so characteristic of the Clarkia and its allies."

Flax.—Although the flaxes grown for seed and fiber are very pretty with their shades of blue and of white blooms and are hardy as grains, giving lovely winter effects, it is the scarlet flax or Linum rubrum which is more striking and notable. It is a graceful plant, from a foot high upwards, bearing bright red flowers in abundance. It grows readily from seed in open ground, from sowing after the fall rains and later in the rainy season.

Forget-Me-Nots.—The varieties of myosotis surely do make it impossible to forget them in California. They grow luxuriantly in all except very frosty times, doing their best in the moderate temperatures of autumn and spring, but active also during the highest

heat of the coast region in moist and shady places. They are very free in self-sowing and if you have ever introduced the plant you may count upon always finding it afterwards, singing its appeal for remembrance in neglected corners.

Foxglove.—Digitalis shoots its tall bell-clothed flower stems sooner than one would expect from its recorded biennial habit and it sometimes lives longer than expected. It is too large for small gardens, except in the background, perhaps, and a little shade agrees with it. It cohabits well with ferns. The seed is fine and growing plants in boxes for transplanting is better than open-sowing. It makes numerous side shoots and these continue beauty after the main shoot has been removed, when its flowers collapse. On large places great clumps of digitalis are very effective.

Gaillardia.—Gaillardia Grandiflora is one of the showiest of perennials, bearing a profusion of flowers from June until winter, and often through the winter in spite of light frosts. It will thrive in any kind of soil. The flowers are borne on long stems, center dark red to brown, with rings of brilliant crimson, scarlet, orange and vermilion, two to three inches in diameter. It is excellent for cutting. It should be more widely grown because of its gay coloring and decorative value; also because it is one of the most grateful and contended plants we have, willing to make a grand display under conditions of hard ground and summer drouth, which throw most other plants into the sulks. Mr. Morris of Los Angeles says of the new varieties which have been recently developed: "The new giant hybrid gaillardias are well worth growing. As they bloom freely they should be in every home garden. These require about four months to come into flowering and once established will continue blooming from year to year. Some of the new varieties produce flowers five inches across, ranging from a deep orange red to a lemon yellow in color, and often these colors are blended most perfectly in the one flower, the center being dark, shading off to the light lemon."

Godetia.—Godetias, or Evening Primroses, are beautiful late spring and summer bloomers from seed sown at intervals of good soil condition during the rainy season, preferably in rather light soil. The colors are hues of red, shading and marking each flower; the flowers being large, cup-shaped and showy, and the plants low-growing, from one to two feet, usually. They require no special treatment. The several varieties differ widely in height and hues and are very hardy, interesting and satisfactory.

Gypsophila.—This is the very graceful plant known as "Baby Breath," which presents such an airy effect in the garden and is so highly esteemed as a substitute for ferns in boquet making. Two

white kinds are chiefly used for this purpose, being very elegant with their web-like foliage and small, white star-like flowers. The plants are easily grown from seed and are very drouth resistant.

Hollyhocks.—These favorites of the old gardens in wintry climates almost double their stature and their blooming season under California conditions and in places of little frost make manifest effort to be evergreen and ever-blooming. The late side shoots of a giant which has thrown bloom ten feet into the air in midsummer, will often give miniature bloom stems two feet high at Christmas. Hollyhocks often bloom within a year from the seed-sowing, thus illustrating the disposition of plants to concentrate their historic two years record into one, as has been previously noted. One will see all kinds of hollyhocks in California gardens, the old tall-singles being still preferred by many for their grace over the denser-blooming doubles. But perhaps the best on all accounts are the Allegany, a semi-double fringed variety which blooms the same summer from early sowing and the Chaters, an English strain which is semi-dwarf and blooms in dense clusters. Hollyhocks are easily grown from open ground sowings; in fact, they volunteer freely all over the garden after their first introduction.

Larkspur.—Larkspurs are almost incomparable for their beautiful blues in large spikes and their elegant foliage of such tropical aspect. Though there are annuals of good service the perennial are generally signified when one says "larkspur" or "delphinium." They have a long blooming season and where frost is light or absent they are to give a rich summer bloom and to repeat it on the new growth in autumn after a short rest in the late summer, or it will continue to bloom if spent shoots are removed after blooming. They are chiefly grown by division of the roots, which should be done during the rainy season, as the ground becomes warm after the coldest weather and the soil freed from standing water; otherwise the roots may decay after disturbance. Although larkspurs are quite worth while, even under rather trying conditions of soil and moisture, the colossal stalks and flowers are the reward for extra deep soil working, abundant manuring and ample irrigation. A scarlet larkspur is becoming more common but the blues prevail. Another very striking species is also scarlet borne on stems bare of leaves and producing a very graceful effect.

Lobelia.—This little, rather tender plant, is unrivaled for its submergence of its small foliage in its flood of deep blue bloom. It is beautiful as an edging plant or for a mass effect. It is an annual even where frost is light, but one can take up a large clump before frost and hold it over in the green house to use for side-shoot cuttings after the frosts are over. It grows readily from seed on proper

treatment for so small a seed and should be sown in boxes under cover to get plants for spring setting in the open. Another very easy way, where the first rains come without frosts, is to take the myriads of self-sown seedlings which promptly appear under and around the old plants. By thumb-potting these tiny plants or pricking them out in flats one can get any number of thrifty little clumps for setting out after frost and thus realize very early effects. There are also tall, perennial lobelias, but they have not yet made much impression on the amateur mind.

Lupins.—These wild legumes in various shades of blue, also in white and yellow, are useful for large effects but not much grown in gardens, because one sees so much of them all over the state from the sand beaches of the ocean, across the plains to the mountain sides.

Lychnis.—The Lychnis family is growing in favor. The double white, the double red and double crimson are most valuable for summer flowering, and produce their charming carnation-like flowers in the greatest profusion all summer; they are excellent for cutting and some of them are exquisitely fragrant. They are easily grown from seed and are apt to run two to three feet high.

Marigolds.—The marigolds can be justly called gorgeous, although their rank growth and aggressive freedom in possessing the earth causes them to be regarded as rather common. The most common, or African marigold, is almost more easily grown than kept from growing. The French marigolds are not quite as easy and are often started in flats and transplanted once or twice before planting out. The French are variously hued and striped and are very handsome, both in flower and foliage, but one never gets very affectionate with any of the marigolds because of their somewhat medicinal odors.

Mignonette.—Mignonette is almost a garden weed, sowing itself and lingering long into the frosty season. It keeps coming from the seed if once introduced to the garden and its exquisite perfume amply compensates for its intrusive behavior.

Nasturtiums.—Nasturtiums are almost universal in California, and though so common, always hold interest because of their acceptance of all hard conditions except frost, and because varieties have been developed of such exquisite hues and interesting markings. Although the plant is so delicate as to serve as a garden thermometer, it is safe through many months in most places, and it seeds so freely that it may always be expected to return in spite of spading and other soil working. It accepts soil conditions which most flowers resent by ill appearance; in fact, for an abundance of flowers it should be grown on rather poor soil. The blossoms are of all the odd shades of yellow and red. The leaves are also variegated in many of the

varieties. Some are dwarf in habit, other tall and used as climbers, and wonderful varieties have been developed in all these lines.

Pansy.—Pansies are a great delight if well grown from choice strains of seed of which a number of seedsmen are making a specialty and a pansy specialist is coming to be regarded as a very high class horticulturist, and his work is well worth attention. At the same time the commonest pansies with the scantiest culture remain popular. Pansies can be grown from seed sown in the open ground during the rainy season, for they are quite hardy; they also root readily from cuttings of their soft substances. But the best way to grow pansies is to start the plants in the late summer or early autumn, as suggested in Chapter XII. Sow the seed thinly in flats or seed boxes, described in Chapter VII. Use finely prepared, light soil, at least one-third leaf mold or other good fiber. (See page 30). Firm the soil on top by pressing down with a smooth board or brick. Sow the seed broadcast, and after it is sown press the seeds into the soil with a smooth board or pane of glass, then cover with ¼-inch pure leaf mold or finely chipped moss. Water with a fine spray, so as not to waste the seeds. Put the box in a cool, shady place, free from wind, and water with a fine spray whenever the surface gets dry; but do not water towards night, or a large percentage of the young plants will damp off. After they are well up—that is, showing two leaves besides the seed leaves, they should be given full sun. After they have made four leaves, they should be planted in the beds where they are to bloom, or should be transplanted into similar boxes, using similar soil. Plant them two inches apart in the boxes. The more a pansy is transplanted the better it seems to do, if it is done while they are small. Some growers give pansies three shifts and the extra fine ones four.

To bring large, fine blossoms, pansies require a rich soil, but should have nothing but thoroughly decayed manure (cow manure is best) and plenty of it. And the ground should be manured in the fall and spaded over several times before setting out the plants for blooming. An eastern exposure is best where they have to be grown in partial shade, but a sunny place is best for my pansies if they are given plenty of water. They give more bloom and the petals have better substance. On grower who tried them in full sun, in deep shade and half shade, found that while the last did well, the bed in the full sunshine was best. They must have deep, rich soil and plenty of moisture to give numerous fine blooms, and if well treated will blossom all the year.

Pansies do exceedingly well with a mulch of sand two inches deep, as it will not bake and the water seeps through readily. It also prevents to a great extent the approach of slugs, which are the worst

enemies of the pansies. The foregoing has reference to experience mainly in the coast district. That a similar method brings fine results in the interior also is shown by the following explicit and somewhat picturesque paragraphs written by Mr. W. M. Bristol of Highlands, San Bernardino county:

"Probably no place better adapted to the production of magnificent pansies than Southern California. The weather from January to July is more or less cool and moist, conditions favorable to the growth of the pansy, and with proper management the plants will produce an immense crop of blossoms of large size.

"To have them come into bloom in January or February, the seed must be started in August. Considerable care is necessary to success at this stage, but after the plants are large enough to remove from the seed bed, the directions for culture are simple, though imperative. Don't believe the threadbare and absurd statement that "pansies like a shady place." Set them where they will receive the full sun but no reflected heat from the buildings. When the weather begins to warm up in June, it is well enough to shade them with light muslin.

"Don't set the plants where you have to dig holes with a pick or blast them with dynamite. Select a good gravelly loam, moderately compact, excavate to the depth of a foot, and as the earth is replaced mix in a goodly quantity of cleanings from the cowyard or chicken house (not too much of the latter). Then thoroughly saturate the mass, and as soon as dry enough to handle, work it over again with spade, hoe and rake and set your plants about a foot apart.

"Don't give them a shower bath with the hose every day or two. It is folly. It hardens and packs the ground while the roots may be suffering for moisture. Once in a week or two make holes or furrows among the plants and keep water therein until the ground is thoroughly soaked. When sufficiently dry, cultivate and pulverize the surface. Remove all blossoms as they begin to wilt. If these instructions are heeded, the rainbow will paint your pansy bed and make it the envy of your neighbor and the delight of the wayfarer. If they are not heeded, you will be heard in the doleful chorus: 'I never had no success with pansies nohow.' "

Penstemons.—Few things are more satisfactory for a long blooming season and especially for winter hardiness and activity than the penstemons, which grows readily from the seed started in the early autumn in boxes and planted out a few weeks later or established well from spring sowing for bloom within a year. The plant comes readily also from soft stem cuttings in sand and hastens bloom thereby. The stems are two feet or more, upright, carrying bell-like flowers, suggesting the foxglove, but very delicately shaded

and mottled with reds and white. The bloom is beautiful and serviceable for house decoration and particularly brightens the garden between the chrysanthemums and the early bulbs, though available far beyond that period.

Petunia.—Petunias are very serviceable in California for their endurance of high heat and drouth, and are easy to grow all through the frostless season and to get continuous bloom during that period. The seed is very fine and needs surface sowing and to get the full benefit of the plant the seedlings should be winter-grown under cover for putting out after frost. California propagators have accomplished wonders in doubling the flower and in bringing its circumference and their work is better known at the East, where the petunia is a very popular house plant than in this state, where it is grown in the open.

Phlox.—Perennial phloxes, making stems about three feet high with full panicles of bloom of various colors, are easily grown and serve a good purpose in masses. The annual phlox (Drummondii) is very bright in colors, low and carpet-like in stature and coloring. It is very beautiful during the frost free period, and is available in many varieties.

Pinks.—These are well known low-growing perennials with grass-like foliage, botanically related to the carnation, but much less popular, though having the same delicious odor. They are easily grown, making no particular soil requirement and some of them exceedingly hardy under neglect. They are propagated either by seed, clump, division or cuttings. The old Scotch or border pink is most frequently seen and it has a very long blooming season in this state.

Poppies.—Of course our greatest poppy is Eschscholtzia Californca, our State Flower, as noted on page 10. This species has such capacity for variation that Dr. Jepson says nearly one hundred new species have been proposed for creation out of it, but this should not lead the amateur to conclude that all our Eschscholtzias are of one variable species, for two others are named and described.* But for us the "Golden Poppy," with its string of pretty Spanish names, is nearly the whole thing. It is interesting, historically, that foreigners have done much for our California poppies which might perhaps never have been done at home. We have the flower in such glorious amount that we thought little of developing varieties, but this was first done abroad, although Mr. Burbank followed with creations more unique than the foreigners achieved. More than twenty years ago, the late Mr. Charles Perry, an amateur rose grower at Birmingham, England, followed the practice of growing eschscholtzias among his standard roses, and, as he always said, to his entire satisfaction. The record before us says: "Mr. Perry always held no harm was done to his plants or the bloom they carried; indeed, he considered

that in summer on dry land the eschscholtzias were beneficial, keeping the soil cool. Mr. Perry had the lemon-colored E. tenuifolia, the yellow E. Californica and the golden E. Crocea. The varieties have since been extended by the introduction of the white form of E. Californica, the rich, the pretty and distinct rosy carmine Rose Cardinal, which is regarded as a variety of E. grandiflora, and the deep rich orange E. Mandarin, which, though placed in seed lists as a variety of E. Crocea, actually came from Rose Cardinal."

This reference gives an idea of how extensive the making of species of eschscholtzia has been for a generation or more. Mr. Perry's plan of carpeting his English rose garden with our State Flower may be suggestive to California growers, but, of course, they must remember that such practice in California might be at the risk of diverting moisture which the roses need and which should be conserved for them by good tillage. As for culture of the plant in California there is naught to do but scatter the seed and rake lightly. After that you will not lose it; it keeps coming from self-sown seed and it also holds on to life by a perennial root which resumes activity even in quite dry land by the touch of the fall rains.

The poppies of other lands dispute possession of California with the native species. They come readily from the seed in open ground, although some start plants in boxes for planting out. The Shirleys are a large group of beautiful annuals which volunteer so freely that their old bed looks like a lawn unless disturbed, and even digging does not suppress seedlings, because some seed is left near the surface. And then there are the old-fashioned single and double poppies in endless statures and colors. All one has to do is to start to keep having them around the place. Besides, there are the perennials, of which the Oriental poppies with their numerous varieties and colors are most prominent and well worth cultivating. The flowers are large and very brilliant in color; satisfied with almost any kind of soil. The Iceland poppies form also a most beautiful group, their bold and bright flowers of yellow, white and scarlet are simply magnificent, and besides their beauty have a very pleasant lilac perfume.

Last of all and perhaps least known though better worth knowing, is the Mexican poppy, (Hunnemannia) which has the general aspect of an eschscholtzia, and of clear lemon, cup-shaped bloom. It is fine for winter bloom and in fact keeps busy nearly through the year. Seed planted in June with enough moisture will bloom in the early autumn and continue through the rainy season—but we do not find it so resolute in holding on as other poppies but likely to disappear through neglect.

*Flora of Western Middle California, page 177.

Portulaca.—This plant does excellently under fairly good conditions in California, although we do not find it quite so tolerant of drouth as ordinary descriptions indicate. If, however, one strikes it right a splendid effect is produced. For variety and intensity of color, the genus has but few equals; the colors ranging from through white, yellow, pink, purple, and the most dazzling vermilion. The flowers are large, about the size of a dollar, and while the single varieties are beautiful, the double ones are much more so. It is well adapted to bedding purposes, whether in mixture, or distinct colors. Perhaps the limitations of portulaca may be inferred from the fact that purslane—called "pusley" at the East and considered the last thing in meanness—does not occur in California gardens.

Pyrethrum.—Pyrethrum Roseum, sometimes called the red Marguerite, is a very showy perennial; bearing its large, deep rose-colored flowers, with yellow disk, for a long time during spring and summer. There are many varieties of single and double-flowering kinds, but the single deep rose-colored one is really the most desirable one. Sometimes single plants have fifty flowers at a time—borne aloft on long, strong and slender stems. It is grown easily from the seed in boxes under cover and if started in the winter for early planting out, is likely to bloom the same autumn if frosts are absent. Established clumps will bloom spring and fall or continuously.

Pyrethrum also includes the "Golden Feather" or "Fever few"—a low, yellow-leafed edging plant, which amateurs often rush for to give striking outlines to their geometry. Plants are grown in boxes under cover and set out after frost danger is over.

Rudbeckia.—This genus includes a group of showy plants called "cone-flowers." They have a daisy-like flower with prominent central tuft or cone of dark color. The most popular is the species called "golden glow"—with high bunches of rich yellow bloom. Best results are attained by frequent root-division to give room for free growth. There are also low-growing species and quite a range of colors. The plants are easily grown from seed in boxes or under proper conditions in the open ground early in the frost-free period.

Salvia.—The salvias or ornamental sages show grand blue or brilliant reds, according to the species, and are easily grown from seed or cuttings by starting while air and soil are warm and adequately moist. Though disliking frost the sages are not otherwise particular and will accept average soil and do well with it; resisting drouth also but more satisfactory when not required to do so.

Salpiglossis.—This plant, with its flowers strikingly rich in mottled and shaded coloring and veined in petals quite unusually, is a splendid summer and fall bloomer from plants grown after spring frosts. The plant is very airy and graceful in style of leafage and flower stems.

Scabiosa.—The old "grandmother's pincushion" has been advanced in size and in coloring until some of the varieties are as delicately beautiful in hues as anything in the garden can attain. They are very popular as cut flowers and are advancing in commercial importance. The plants are readily grown from seed after frost in open ground, or can be grown earlier for transplanting. They volunteer very readily and care not whether growing in the garden or by the roadside.

Schizanthus.—This is called the butterfly-flower from its orchid-like blossoms. It is of medium height, and a mass of bloom but not holding it long. Plants can be readily grown in open ground and several sowings should be made at intervals to continue blossoming. They enjoy partial shade when summer grown, but in most places will do well all through the growing season.

Sweet Peas.—Sweet peas are a particular pride of California—horticulturally, esthetically and commercially, they are notable in this state. California growers have not only set the world's pace by development of new classes or types and varieties, but they are in the lead in seed production, and California grown seed is distributed around the world through wholesale supplies grown for distant distributors. The literature of the sweet pea is extensive—many booklets having been prepared by specialists, the latest by C. C. Morse & Co., who have been leaders in the sweet pea industry of California for a quarter of a century. The following general suggestions are from a brief statement written by Mr. Lester L. Morse several years ago, which will do well to awaken beginners to the desirability of making sweet peas a particular feature of their gardens and indicating what they can easily do with them:

"Few flowers breathe out a more delightful perfume, few have greater variations of color, and very few are more attractive in the garden or more delightful in the room than sweet peas. They fit in almost anywhere and they fill in almost any place—they keep well, are easy to grow and easy to keep.

"You can have bloom in California almost any time in February by planting the seed of the early varieties in October in a sheltered spot. Or you can get a wealth of bloom of all varieties in May by sowing the seed in December and letting the early rains do the irrigating for you. You can have blooms all summer by planting at intervals all winter, but the prettiest blooms for most of the country are those that come in May before the hot and dry weather sets in. In foggy climates where the soil is good, especially along the sea coast, the blossoms are usually larger and the colors brighter than elsewhere. But the sweet pea likes sun in most of our gardens, and does best in a good open place away from shade, and they are usually thirsty and enjoy lots of water. The vines should not be sprayed but water should reach the roots; dig a small trench

along near the roots and put the hose in and let it run—then fill up the trench with dry dirt and let it be for several days.

"The seed should be planted thinly and about an inch deep in a furrow about four inches deep—one plant every six inches is close enough. The cut worms love young sprouts, so one should use soil that has been clean and free from the weeds for a season, if possible, as the worms will be less likely to come. For a small row of plants where worms are known to abound it is well to start the plants in posts or boxes and transplant when about four inches high—they are almost sure to grow then if care is used in transplanting.

"The tall or climbing sweet peas need strings or wire to climb on. They love a fence or low shed, especially where there are no shade trees overhead and where it is open and light. In good rich soil with plenty of light and lots of water and plenty of room the plants are sure to be strong and vigorous and the stems long. If one's garden is large enough it is well to have a trellis along a walk and have a row of sweet peas to climb on it. A pretty border effect is had by planting Cupid sweet peas, using one color rather than mixtures. They do best in gravelly soil well watered and fit in nicely along walk.

"A suitable location for tall sweet peas is not at all adapted for Cupids and they must be treated as widely distinct flowers. If you want a mass of bloom covering the ground, you need Cupids. If you want a great wealth of bloom and flowers to gather, of course you need the tall of climbing sweet peas. There are 150 different varieties and you can have them in all shades of red and blue, but as yet no yellow—only buff and light primrose. You can have them in stripes and blotches, in shadings and blendings and contrasting tints, in light shades and dark shades, in soft tints and bright colors."

There are, of course, intensive arts of deep tillage, manuring, etc., by which the very largest thing in exhibition sweet peas is produced, but that is a little beyond our reach. If one catches that fervor he will pursue the subject through the professional publication.

Snapdragons.—These old-fashioned flowers are grown by many as a reminder of old times, though some of the improved varieties show them to be flowers of today. The plants can be sown in the open after the ground gets well warmed, and there will be a good summer growth, followed by autumn and winter bloom also in many places.

Stocks.—Stocks are grown by many with very satisfactory results, but are often abandoned by amateurs who fail to give them the required attention or start from inferior seed. Disappointment results from so many seedlings coming single, but these should not be nursed as a grievance but pulled up and attention concentrated on plants of good type of bloom. This is now attainable in a great variety of colors, and the plants are hardy, easy to start in the open ground in the spring, although better

satisfaction generally comes from transplanting from seed boxes. Bloom will come the first season and many kinds hold over for a second year's bloom, but they require cutting back or they become ragged and unsightly.

Sweet William.—This is a dianthus and is separated from the "pinks" above because of its different style of foliage and bloom—but the plant is being improved so that the contrast seems less. The new sweet williams bloom in a few months, instead of going over to the second season and the bloom is much larger and more significantly marked. As they are hardy they may be planted in the fall for spring bloom and in the spring for fall and early winter bloom. It is more satisfactory to grow in boxes for planting out than to start in the open, though that is possible, especially with the spring start.

Sunflowers.—Sunflowers of the ornamental class are becoming more popular even in a state where the native vegetation of the great valleys during the summer is largely helianthus species. The new varieties are very floriferous, widely different in stature and in style of blossom, but all, of course, yellow of the brightest hues. They are serving a good purpose for cutting for decoration as well as gilding the vistas in large gardens.

Verbenas.—Verbenas spread over the ground rapidly in California, endure considerable drouth, though less handsome thereby, and accept all temperatures except in very frosty places. They do not, however, forget their enjoyment of warmth and welcome the early summer with their heaviest bloom if they have fairly good soil to do it with. Plants are ready grown from cuttings, from running stems which surface root themselves and from seed. A good planting of seedlings from small pots makes the best foundation for a quick and uniform mass effect. There are a number of notable, well marked color creations in verbenas offered. Personally we get most satisfaction from a solid-colored, light purple which is very thrifty and contented in full sunshine in rather a hot exposure and keeps up foliage and bloom all winter also.

Violets.—Probably all the improved violets have found their way to California and all find a congenial home and full appreciation. San Francisco has almost a continuous supply of violets and the growers have all the popular varieties. Violets will make good until growth and bloom in the open air may be allowed to almost disappear toward the end of the summer to revive with the first rains to a new season of drouth and bloom. But it is not well to submit the plant to too much stress. They should have water enough to keep in good life during the dry season. Although they will accept rather a poor soil, they ought to have at least moderate manuring, though excess induces too much leaf growth. To get flowers early from active plants, the runners should be removed.

Violets root readily from running stems or from divided roots, all through the growing season, but establishment is best undertaken in the spring or early in the autumn. Such plants make large, blooming clumps in the open air in California, just as they do under the semi-protected frames at the East. If the plants are allowed to take a summer rest all the litter should be raked off and the surface between the rows loosened to get the full benefits of the early rains and insure the wealth of holiday blooming. As the picking thereof must continue during the rains the writer has found it most convenient to grow the plants as a narrow border along hard walks, to avoid stepping on rain-softened ground. The very large, single, deep blue and long-stemmed violets are most popular. The variety called "California," which is really a re-named Frenchman, is largely grown, but others of similar characters but with a wider-flaring flower, like the Princess of Wales, are probably superior. Of the doubles the Marie Louise, medium purplish, with unique red fleck in the center, has long been a favorite, for foliage, flower and stem. The old Neapolitan, very light lavender and very floriferous, has been discarded largely for scant foliage and short stems. The writer highly esteems Lady Hume-Campbell, as it has Marie Louise character of foliage and stem and bloom of lighter hue, though darker than the Neapolitan. For double-white the Swanley still probably remains the best, but all whites are neglected.

Wallflowers.—These flowers of our grandmothers are still widely esteemed and in California are very satisfactory. Their unique colors are not fully assumed by any other plant and their rich, clean foliage is always delightful to gaze upon. But one cannot get the fullest joy from wallflowers which are neglected—patent as they are under it. Their low shrub-like growth only does its best by pruning systematically to remove spent-shoots, when there is no frost to remove it. and to encourage new growth, and they should not be allowed to famish for water in trying to make it. A little piece of brick or stone wall, and its wallflowers before it, will probably always remain a joy in an amateur's garden and in California the joy is not of a fleeting summer but of the year in places where frosts are light. The plants come readily from sowing in the open after frost or may be box-grown for transplanting—blooms coming the first year and ever afterward.

Zinnias.—Zinnias are the delight of the beginner from childhood upward, so easy, rapid and showy they are. They are also useful to more experienced gardeners, for they have such a wide range of colors so freely displayed. They are, however, quite sensitive to frost, and to get the best of their annual character the plants should be started early under cover and transplanted as soon as safe in the particular place chosen for them.

CHAPTER XVIII.

BULBS, TUBERS AND ROOTS.

The plants next to be discussed are as well entitled to be classed as herbaceous as those considered in the preceding chapter. They are separated from their allies for convenience, because they make their top growth not from a seed but from a resting stage in a bulb, which is an underground dormant bud in which the plant has established the potentiality of further growth or of flowering and stored food for it; or in a tuber, which is a thickened stem or root or both; or in corms, root-stocks, etc., of less distinctly rounded forms—all performing a similar office in carrying several dormant buds and the food supplies with which they may begin subsequent growths. Amateurishly at least, it may be suggested that there is some analogy between the growth of the plants from all these forms, and from the seeds, which the plants also produce, and therefore resembles the propagating of other plants from seeds or from buds and grafts—as outlined in Chapters VI, VII and VIII. Bulbs, tubers and roots are parts of the old plant and reproduce it exactly; seeds from bulbous or tuberous plants have the same tendency to variation, natural or artificially produced, that is involved in other seeds—greater or less according to conditions and circumstances.

California Conditions for Bulb Growing.—Probably the botanists would support a contention that California has exceptional conditions for bulbous plants because of the many and uniquely fine native plants which have that character of growth. The florists' trade demonstrates the world's view of California native bulbs by the demand, which has been developed from a little half-amateur collection and distribution to a well organized business. The resident and traveling plant-lovers proclaim the fact with characteristic exclamations, while the enthusiastic amateur gardeners have pitted the state with prospect-holes for bulbs more abundantly than the miners ever did for gold. But proper recognition of this subject does not rest with us: it belongs with the botanists, the poets and the commercial collectors. We enjoy it all, as an enthusiastic amateur should, but we do not try to teach either facts or significance of it.

From the gardening point of view it is, however, clear that our vast wealth of native bulbs is being transferred to California gardens more abundantly and successfully than hitherto, because the commercial collectors are each year making supplies more available and are distributing excellent suggestions as to how the conditions to which these plants are born can be simulated in our gardens, and some

of these may be cited later in connection with mention of plants to which they belong. But the fact which is more closely related to our task is that bulbs from everywhere in the world are becoming wonderfully popular in our California gardening policy; our leading California seedsmen issue special bulb-catalogues which all should secure and study, and bulbous flowering plants are now displayed in abundance in city, suburban and rural gardens where a decade ago their appearance was exceptional. These facts are all significant in their demonstration that these plants are eminently desirable and their culture is within ordinary gardening skill and patience. Below all this is, however, the fundamental fact that California valleys and foothills have really no closed-season for bulbs; that the "spring-flowering" bulbs of wintry climates may begin open-air bloom in December and continue until May; that "summer-flowering" bulbs may spread their gorgeous colors from May until November; that while we not only lose no desirability that may inhere in pot-grown bulbs for portability and decoration, but really can secure this with a fraction of the care and cost which is required in wintry climates, there is added to this the more important advantage of growing the same bulbs in the open ground and air at the same times of the year.

What Easter Lilies Say of California.—It is thus made clear, from the course of the floral trade and from common observation in amateur gardens, that California has exceptional natural endowment for delight in bulbs. Perhaps an authoritative declaration from the highest national authority may also be appreciated by distant readers who cannot see the common facts which have been cited. Take then the Easter lily for a test, because to have the name it must be in bloom at Easter, and that in ordinary northern latitudes is impossible to realize in the open air. But in California experiments were tried under the supervision of George W. Oliver, bulb specialist of the United States Department of Agriculture, of which the record* gives the following concrete facts: "Fred Rafferty of Santa Ana bloomed a large number of the hybridized seedlings of the lilies giganteum and harrisii. Although the seedlings were only about three inches high in June, 1906, some of them had twenty-eight flowers in June, 1907. Such plants can be depended on to give bulbs of salable size the first year. The crop is ready for harvesting in August and the smaller bulbs, when replanted soon after harvesting grow much better than the imported material."

It is true that this does not verify open-air blooming at Easter, but that is a fact nevertheless, in many places with high winter temperature, although house-grown plants are the surety of being in time

*The Production of Easter Lily Bulbs in the United States: Bulletin 120, Bureau of Plant Industry, U. S. Dept. Agr., 1908.

in most places in California where they are commercially grown. But the statement of Mr. Oliver has a wider significance in that it demonstrates the length of the California growing season, which brings a mass of flowers from the bulb within a year from the time it started from a seed, and, of course, it does that because the winter months are included in its open-air growing season. This is cited as a demonstration of the fact. In common garden practice, which will be described later, these flowers are best grown from bulbs, which is the form in which the florists offer them for sale. And such bulbs planted early in the rainy season in proper places are the ones which bring the Easter blooms in the open air.

HINTS ON BULB GROWING.

Although, as indicated, we have an ever-growing climate for bulbs and therefore more latitude than those who have to work with short, changing seasons, it is still true that great advantage pertains to doing things at the right times and the right time to plant a bulb is just as soon as the growing conditions, which best suit it, arrive. This is what is meant by all exhortations to "plant early"; it is early for the bulb, not by the calendar. For instance, by the ordinary use of the calendar, January would be early and September would be late; but, by the daffodil, September is early and January is late—in fact very late indeed, for then some of the same class will be in bloom from early planting. Each group of bulbs of similar tastes has its own requirement of conditions for activity, which may be the shooting of roots or of flower-stems or of opening blossoms or of finishing its growth by sending down food, for its own refreshment or the building of its bulblets. Each bulb is therefore busy with making roots for some time before one sees its leaves and busy making canned-food for some time after its blossoms have faded. If it remains in the ground for several years together, as most bulbs do successfully in our frost-free soil, it will take care of its own growing season, but if one desires to replant bulbs or to put in new bulbs from the dealers, it should be done as nearly as possible at the time when that kind of bulb would begin making roots if it had been undisturbed. Again, though the planter has some privilege in the way of getting somewhat later blooms by planting bulbs at different dates, he is apt to lose in condition more than he gains in time, because the bulb will be disposed to hurry to make up for lost time and will not have as good roots below or as good bloom above as when it can take its full time to do its work. Therefore it is better to plant about when it is natural for that bulb to begin and rely, for a succession of fine flowers in the bulb beds, upon the fact that some kinds of bulbs require more time than others to make flowers, rather than to try to force an early bloomer to bloom

late. Fortunately we have so many bulbs, which enjoy different parts of the California year, that it is quite possible to have an unbroken succession and still have each flower at its best. Still we actually have a very long planting season for bulbs, as we have for other kinds of plants, as indicated in the suggestions of monthly work in Chapter XII, and it is possible to plant winter-flowering bulbs from September to November and get a succession; all being from relatively early plantings.

Soil for Bulbs.—Another set of conditions to arrange for is those of the soil. Practically all bulbs demand soil conditions like those described on pages 25 to 31. Possibly most of them are more exacting of proper conditions of warmth and absence of surplus water than many other plants are, because their large masses of food-substances are more liable to fermentation and decay than are the tissues of fibrous-rooted plants. Certainly most of them are very ill-placed in cold mud, because their growth processes are arrested; and some of them will grow in water which is at 60° and decay in water-soaked soil at 40°. Therefore do not plant bulbs in low wet places unless you happen to know that the particular bulb or fleshy root is of semi-aquatic habit.

Planting Bulbs.—As a rule a good deal of sand is a good component of a bulb bed, because it helps the access of warm air and ensures the escape of surplus water. This is the reason why it is frequently prescribed that a little sand be placed in the bottom of a hole prepared for a bulb and some add a little coarsely powdered charcoal, which is believed to have a tendency to prevent decay.

But we do not believe it is best to plant a bulb in a hole made by trowel or dibble. We prefer to plant in a trench opened with a hoe, or, if very deep planting is required, as with some of the lilies, with a spade. One can then see the whole line; the depth is more easily made uniform; the sand or coal ashes (page 28) can be evenly distributed; the bulbs can be placed at uniform distances and pressed down into close contact with the sandy bed. The first soil used in filling should be pressed down around the bulbs and the covering lightly disposed. This is what our experience approves as planting bulbs in a workmanlike manner.

Depth in planting bulbs is a very important consideration and impossible to determine by direct prescription, although suggestions in that line will be given later. It is really a matter to be rationally decided in accordance with the character of the bulb and the soil, remembering that the tendency of the bulbs, as they cluster by offsets, is to crowd upwards. For the security of moisture supply and to escape the heat and compacting of the immediate surface, bulbs should be well-covered and the addition of manure and mulching, which will

be mentioned later, is desirable toward that end. Depth of planting bulbs, as related to the character of the soil, is analogous to that discussed for seeds on page 58. An arbitrary rule often cited is that the depth below the surface should be twice the greater diameter of the bulb—that is, measured vertically if it is a tall bulb, like a narcissus; or measured horizontally, if it is a flat bulb or corm, like a gladiolus. If one must have a rule, perhaps this is as good as any for a well-made garden soil, as discussed in Chapter III, but the depth should be greater on light, sandy soils and less on heavy soils, likely to be cold and wet—and so reasoning becomes indispensable. In determining the depth of planting, distance should be measured from the top of the bulb to the ground surface, and not from the base of the bulb.

Garden-Places for Bulbs.—Although scattered clusters of bulbs can be effectively used in borders of mixed flowers or put in singly here and there is you like, the most rational way is to grow them in beds or borders by themselves so that you can arrange for their rest or activity without compromising with other growths in some way. Of course you can make a great front-lawn display with bulbs in succession or you can transplant other plants to take the places of bulbs as they mature and to conceal their decrepitude when they are necessarily in the sere and yellow leaf, but unless you have an unusual amount of leisure you will have to hire a gardener, and that throws you out of our class of working amateurs.

Our choice is to locate the bulb-areas in the rear yard or at the side and not to rely upon them to please the passer on the highway, except as he may catch vistas of them between and beneath the trees—although we have had very good success with them along the secondary walks through the fruit trees, just back of the violet edgings. In this way they stray into and out of sight from the street and do not flash boldly into view.

In their own areas we prefer to grow bulbs in straight rows—not less than a foot and a half between the rows, so that one can freely hoe up and down the rows; or in curves, if you like, providing good hoeing space is given. It is a mistake to put them in fantastic figures or to jumble them up and thus make cultivation always dangerous, if not impossible. In the well separated rows, the bulbs should not be set too thickly. The dealers usually give wide range in their suggestions as, for instance, "from six to twelve inches apart." We always take the greater distance when a range is given. The seedsman cannot be blamed for trying to help the amateur, who has small space to get in as many dozen bulbs as possible. So many bulbs should be left undisturbed for several years, and they show their joy of it by making such a large clump, that it is a mistake to set them too thickly at the beginning.

Another reason for growing bulb beds out of main sight is that one feels freer to use the mulches which are of great advantage both winter and summer. After planting spring bulbs in the fall a ground-cover of dead leaves, rotten straw or old coarse manure will prevent surface-packing by heavy rains, and mulching is also good for summer and fall bloomers, because it holds moisture from flying away and helps to get full duty from irrigation water. Fresh manure should be used very thinly, if at all; it is not usually good for the growth of bulbs.

Summer Treatment of Winter Blooming Bulbs.—Still another reason for not making bulb plantations too prominent is the fact that the leaf growth after blooming should be allowed to mature in a natural way because this foliage is still discharging its function of storing food in the bulb for its next blooming or for the growth of its offsets. When the top dries down, this work is complete and the rubbish may be raked off, or allowed to remain prostrate as a mulch or cover to check evaporation.

And that leads to the remark that the proper dormancy, which a bulb should have after its top-growth dies, is not desiccation. In our dry summer climate too much emphasis is sometimes placed upon withholding water from ground containing dormant bulbs. The advice may be good to some native bulbs which are born to hard-drying, but all others do not prosper by it. Many of the bulbs we grow are native to moist climates where there are summer rains after blooming, or to moist soils in our own state. Therefore do not let the soil dry out and bake like a rock. Loosen the surface a little after blooming, cover with a mulch and put on a little water once in a while, unless you see that the soil is prevented from becoming absolutely dry through some natural soil-moisture movement or through lateral seepage from adjacent irrigated areas.

But the surface soil over the resting bulbs need not be left to itself nor covered only with a neat mulch. It is quite possible to grow shallow-rooting covering plants and the occasional summer watering given these plants will keep the soil right for the bulbs. When the spent foliage of the winter and spring flowering bulbs is cleared away, give the surface a good raking and scatter the seed of mignonette, nasturtiums, summer poppies, or some other rapid summer-grower which you like. The bed becomes a summer ornament and can be enjoyed until September or October, when everything ought to be raked clean and a thin covering of good manure spread to be leached out by the fall rains. It is of course possible to scatter seeds with this fall working and thus bring up eschscholtzias or other winter bloomers. The writer really enjoys the California poppy foliage

among the stiff narcissus leaves, but it would probably be better to grow plants like alyssum, nemophila, etc., which do not root so deeply as the poppies.

Shall the Bulbs Be Undisturbed?—All these suggestions are based upon the affirmation that the bulbs shall be given their special places and should be allowed to remain in the ground to take their resting. We are convinced that such is the proper treatment for nearly all the bulbs the working amateur is likely to grow—only digging them up once in three to five years to separate and replant singly the bunched-bulbs which will be crowding each other. Some modification of this suggestion may occur in the later discussion of particular plants.

Protection for Bulbs.—Although dormant bulbs are reasonably free from injury by ground-vermin, one must always be on the guard against gophers, which seem to have an appetite for bulbs which increases with the price you pay for them. One may conclude that he has no gophers on the place until he buys a lot of costly lily bulbs —which are cake to them, although they will eat others also. To make a bed for a small bunch of bulbs you may do as advised for carnations on page 151. To protect a larger bed, dig a trench all around it eighteen inches deep. Take 3-ft. chicken fence netting, one-inch mesh, and cut it lengthwise into two strips eighteen inches wide. Stand this up against one side of the trench with the selvage up and the jagged wire-ends down. Fill in the trench so that the selvage will be just out of sight under the surface. Gophers cannot get through it and efforts to dig under cause the wire-ends to catch in their backs. Such wire is, however, of rather short life through rusting. A Fresno grower makes a permanent barrier around bulb-beds by digging a trench around the bed and filling it up with tin cans, bottles, broken dishes, etc. These things should be buried anyhow, for it is abominable to load them on a wagon and dump them at a distance on the roadside because of laziness.

BULBS CHIEFLY COMMENDED IN CALIFORNIA.

We do not assume the function of specifying what bulbs an amateur should grow. We would probably differ in tastes, and besides we are not sure if we would choose the same bulbs if working in places different from that in which our experience and observation chiefly lie. We shall try to indicate, rather, the bulbs which our various sources of information commend for California and advise the beginner to go to it and decide for himself which bulbs best suit his conditions of climate, soil and moisture, his moods and his money.

What to do with the various bulbs and when to do it, may appear in connection with the comments on the bulbs which will be mentioned later. Suggestions will also be found among the details for

monthly work in Chapter XII. Data concerning methods and times with the various approved bulbs, tubers and roots are tabulated as follows:

Kind	Depth to plant* (inches)	Distance apart (inches)	Time to plant	Bloom
Agapanthus	4 to 6	24	Oct. to Feb.	July to Sept.
Allium	3	3	Jan. to Mar.	Apr. to May
Amaryllis	2 to 4	12	Sept.	June to Aug.
Anemone (spring)	1 to 2	6 to 8	Oct. to Jan.	Dec. to Mar.
" (fall)	2 to 4	12	Jan. to Mar.	Oct. to Dec.
Begonia (tuberous)	½ to 1	12	Apr. to May	Aug. to Sept.
Callas	2 to 4	24	Sept. to Feb.	Apr. to Aug.
Cannas	4 to 6	24 to 48	Mar. to Apr.	July to Aug.
Crocus	2 to 4	4 to 8	Oct. to Jan.	Dec. to Feb.
Cyclamen	1	12	Oct.	Apr. to May
Dahlias	2 to 3	24 to 48	May to Aug.	July to Oct.
Freesias	1 to 3	4 to 6	Sept. to Oct.	Dec. to Jan.
Gladiolus	3 to 4	8 to 10	Feb. to Jun.	July to Oct.
" dwarf	2 to 3	6 to 8	Oct. to Dec.	May to June
Hyacinths	4 to 5	6 to 8	Oct. to Jan.	Feb. to Apr.
Iris	3 to 4	10	Aug. to Feb.	Mar. to June
Ixias	2	3 to 6	Oct. to Jan.	Apr. to May
Lilies	5 to 8	12	Oct. to Dec.	Apr. to June
Lily of Valley	2 to 3	12	Oct. to Feb.	Mar. to Apr.
Montbretia	1	3	Oct. to Mar.	May to July
Narcissus	3 to 5	8 to 12	Oct. to Jan.	Dec. to Apr.
Oxalis	2	4	Aug. to Sept.	Dec. to Apr.
Ranunculus	2 to 4	8 to 10	Oct. to Jan.	Dec. to Mar.
Snowdrops	2	4	Sept. to Oct.	Dec. to Feb.
Sparaxis	2	3 to 6	Oct. to Jan.	Apr. to May
Tigridias	2 to 4	4 to 8	Mar. to Apr.	May to July
Tuberose	4	8	Jan. to Feb.	May to June
Tulips	3 to 4	6 to 8	Oct. to Jan.	Mar. to Apr.
Watsonias	3 to 6	8 to 12	Sept. to Oct.	Apr. to Sept.

Suggestions of desirable characters in the plants thus enumerated and particular methods employed in the growing of each may be cited as follows:

Agapanthus.—This is often called the "blue African lily"—a large plant remaining in place indefinitely and sending up each summer and autumn stout stems crowned with clusters of bright blue flowers at a time when other bloom is scarce. The foliage consists of dark green short swords with rounded ends; thick, glossy and evergreen. Our plant has been in the center of a bulb-bed for twenty years and has always been admired. By outward extension it now forms a circle nearly four feet in diameter, around an open center which it chooses not to occupy. It is well adapted to prominence on a lawn, where a low plant is desired. The plant is very hardy and will endure dark shadows and hard ground if necessary.

Alliums.—Two members of the onion family are quite largely grown in the open air, though chiefly grown in pots elsewhere. They are low plants with rather scant foliage, sending up a flower-ball on a tender

*Depth is counted from top of bulb to surface of ground.

stem. One has a yellow bloom. The other, which is better known, is Allium Neapolitanum, an early flowering bulb. The white flowers are produced in large umbels about fifteen to eighteen inches high. Very little care is required in its cultivation.

Amaryllis.—Amaryllids are in two classes, which may be popularly distinguished from the fact that one, the common "belladonna lily," sends up a flower stem after the foliage has disappeared, or it may be said to bloom before the foliage appears—the former being probably the more correct statement, for the bloom must be the work of the preceding and not the following foliage-effort. The bloom appears in midsummer and is gorgeous. in its rose-pink profusion of lily-like flowers on a stout, dark stem which has force enough to uplift hard, dry ground, but should not be required to do so, for the soil should be kept reasonably moist after the foliage dries and disappears in June. Generally in the month of September, and after the flowers wilt and decay, the bulb begins its growth, and grows through the winter and spring months. If it is desired to move and divide the bulbs it should be done in September and October. Immediately after the flowers wilt, and before any growth starts, take them up, divide and replant and they will go ahead and grow their foliage and form a dormant flower bud for the following summer, and when the time comes, they will bloom as though nothing had happened. They cannot be moved at any other time of the year without postponing the bloom until they re-establish themselves. They will be satisfactory for years without disturbance.

Some amaryllids are evergreen and do not lose their foliage as above described, but the best time to move them is after the flower has recently disappeared. Mr. Burbank has produced most wonderful hybrids suitable for open-air growth in California. They are immense in size and fairly startling in brilliance of colors and uniqueness of markings.

Amaryllis bulbs are large and should not be planted as deeply as the rule, previously given, would prescribe. They should have the stem end but an inch or two below the surface, usually.

Anemones.—There are two groups of anemones: one low, wholly herbaceous, growing and blooming during the California winter and spring and classed as spring-flowering bulbs. The other anemones are of taller growth, making more woody stems and classed with fall bloomers. These two classes taken together constitute one of our most attractive complementary groups of flowers included in a single genus.

The spring flowering anemones form small bulbs with peculiar pointed extensions which should be placed downward—soaking the bulbs in water before planting. The bulbs should be but lightly covered and can be set six or eight inches apart. The varieties include

PLATE 9: "THE LATER FLOWERING TULIPS ARE THE ONES FOR THE AMATEUR TO GROW"—PAGE 204.

single and double poppy-like flowers of wide range of colors: white, blue, scarlet, pink, coppery red, etc. There are giant strains of great vigor, but all are a foot or less in stature, with occasional reaches to a foot and a half.

The fall-flowering or Japanese anemones, which in habit differ from the foregoing, keep their foliage throughout the year. There are several species and varieties, including hybrids, all of which are very desirable. Colors are pure white, dark rose color, carmine. The flowers are produced in great profusion, two or three inches in diameter, well above the dense foliage; both flowers and foliage very graceful. The plants accept any soil, though they thrive best in rather light and loose soils, and will thrive in shade like ferns, with which they may be inter-planted with beautiful effect. The plants should be mulched during their winter resting and suckers removed to prevent too thick matting—retaining the old clumps, which will be good for years. Transplanting should be done during the dormant period after the fall flowering.

Begonias.—Comment is restricted to the tuberous-rooted group. These plants created much excitement twenty years ago, because of their gorgeousness and when temperatures, exposures and moisture in air and soil are just right, they are unrivaled in their effects, but amateurs have, as a rule, found them too exacting in their requirements. Those who desire to try them can hardly do better than follow the hints given by Fred Rafferty of Santa Ana of their requirements: "only in sheltered, protected locations are tuberous begonias at all satisfactory. But whenever all conditions are just to their liking, there is scarcely a flower grown that will attract more attention. The small bulbs start easily if placed in a pot or box of leaf mold and sand in April. Cover about one-quarter or one-half inch and keep always moderately moist. When well started put into five or six-inch pots or set out in the open. The soil should have a large addition of leaf mold and frequent watering is necessary. The top of the soil should never be allowed to become quite dry. They do not enjoy a high temperature. Anything over 70° is unnecessary, and over 80° is more or less harmful; 55° to 60° at night is the best, so that the cloudy nights and damp mornings of May and June in the coast district are just suited for them, and they make a strong, sturdy growth of large, crisp, green leaves that cover the ground sufficiently to materially lessen evaporation. On this account a large plant will, during July and August, seemingly require less water than a small one in order to thrive well. A good strain of plants will show very large flowers, four to six inches across, on strong, upright stems, and the colors will be bright and pure. Dull colors are not common among them, and flowers shading from one color into another are not plentiful either."

Calla.—Grateful mention is made of the calla, or "calla lily" as it is commonly called, because of the eminent services of the plant in the demonstration of the ethereal mildness of the California climate. That a plant which in wintry climates must be held as an indoor pet would run wild and grow all the year in some parts of California and attain such colossal size that it would require a barrel instead of a small pot to accommodate its roots, was probably more influential than any other single thing in winning or commanding attention to the salubrity of California. But having accomplished its local life work the calla now seems sinking into grateful memory, for the plants are now as little seen as they were formerly abundant. Its dark green foliage and dazzling white bloom, with golden finger pointing significantly to California are but seldom seen now in gardens to remind the pioneer of the ingratitude of the present generation. As for culture the calla is so hardy that it brooks any treatment, even to transplanting in full bloom, although that is cruel. September and October are good months for planting. Callas will grow in any soil and take any water they can get—growing in ratio to the supply. In the colder places they will disappear with frost and reappear in February if sun heat invites them, while in frostless places they will disappear with drouth and reappear with rains to maintain continuous winter bloom. With neither frost nor drouth they are nearly evergreen.

Canna.—Cannas serve an excellent purpose as a background of tropical foliage of various shades of green or bronze, and the newer strains present flowers of gorgeous hues in midsummer when garden-coloring is deeply appreciated. The improved varieties with most showy flowers are of shorter stature than the older kinds, which are characterized by more foliage hues and freer bloom-shoots of small, brilliant flowers—therefore a good border or screen-effect can be secured with the latter in the background. Cannas enjoy high living and the less hardy are apt to disappear under neglect which denies them the food and drink which they require. Although the old kinds will endure for years in place, for good effects taking up the clumps after the top growth disappears, storing in a cool place and re-setting in the spring, just before advancing heat renders the roots active, is desirable. Root-clumps with two or three eyes each should be separated and set at from two to four feet apart, according to the stature of the variety. Interesting results can be had from seed by amateurs who fancy the plant. The seed is very hard and shot-like, whence the old name, "Indian Shot," for the plant. The seeds are difficult to start because of their hard covering and should be put in very hot water, and soaked for several hours before planting. One can pour nearly boiling water upon them several times, soaking them at intervals until

the outer skin cracks open. They germinate in from ten to fifteen days, and may be even longer in starting. Many persons fail with seeds, probably from want of thoroughly soaking to soften the hard shell. Instead of soaking, one can file down a spot in the shell or cut carefully with a knife to admit moisture to the germ within.

Crocus.—It probably needs a patient professional gardener or an amateur who has much of the poetic temperament to get much joy out of crocuses. They have to be handled just right to get a good start, followed by good luck to get the bloom out of pounding rain drops or splashing mud, which disfigure them. Some have held that the crocus thrives better in colder climates, for the reason that in cold climates roots are developed before new growth is made, while in a mild climate like ours the bulb will start its upward growth before sufficient roots are developed to maintain the growth. Add to this the fact that the crocus bulbs are often poor, and that they are planted too late, and it is not surprising that they give little satisfaction. But one can get good crocuses by planting in October, good round bulbs in boxes, and keep them out of doors in a cool place, and in February one will get a mass of well-developed flowers. As a border plant for early flowering they can be handled by mulching to keep the low flowers from mud-splashing and to hold the little bulb in moist surface soil, if there are no rains. One can do such things or he can put the bulbs in the grass plot and let them do as they like in a poetic way.

Cyclamen.—Although almost exclusively a pot plant and very delightful as such, cyclamen persicum can be handled in favorable places in the open air, and as we do not care to mention only easy things, we note the fact for the ambitious amateur. Cyclamen persicum is one of the sweetest flowering bulbs under cultivation, and if properly treated will not only flower early, but will keep in bloom all winter. They are quite fragrant and vary in color from pure white to a dark purple. If grown in pots choose a rather heavy loam with good drainage. They like a cool atmosphere and must be kept clean from insects. They should be planted in pots so that about one-third of the bulb stands above ground, but in the open must be lightly covered and mulched. The variety known as Cyclamen persicum giganteum is by far the best and sometimes shows fifty flowers at one time. They can be grown from seed so as to flower within one year.

Dahlias.—Dahlias are the glory of the California late summer and early autumn, leading up to the glory of the chrysanthemum and sharing it, if late planting is observed. There is now such a range of forms and colors that all tastes are met and satisfied. A very interesting note of appreciation and advice is this, from Mr. Ernest Braunton of Los Angeles in the California Cultivator:

"In all parts of California I notice the dahlia is a great favorite and is found in nearly every garden, both in city and country. If you are situated in what is called a frostless belt and have a spot of really warm exposure, a very early planting will result in flowering the dahlia during the cool weather of early summer. But if you store the dahlia tubers in a cool, very dry place, preferably dark, buried in deep boxes of perfectly dry sand and plant out, after the hottest days of summer have passed, in a rich, loose soil, rather deeply, and water freely, you will have fine autumn bloom. After the tops are growing keep well watered and fed and 'on the move' all the time. Stake and tie the tops with care, and in the cool of autumn you will have dahlias that will prove your heart's delight. These flowers are especially adapted to California soils and conditions, being native to nearby territory."

This suggestion applies to places with a long frostless season and high summer heat, but it applies also to places where autumn warmth can be relied upon even if the summer temperature does not run so high. In such places planting late in the spring, encouraging growth during the cool summer and bloom in the early autumn gives excellent results. The obvious conclusion is that one can largely determine what the dahlia shall do for him by regulating the dormancy and activity of the tuber intelligently, he who works too closely to a fixed calendar does not get all that the flower can do for him.

After the top growth dies take up the tubers, cutting off the old dry stems and store the bunches of tubers as Mr. Braunton suggests. We have succeeded admirably, with less labor than the sanding and boxing, by packing the immense clumps closely in a dark, dirt-walled cellar under the house. It is amply dry during the rainy season and cool during the spring and the tubers keep dormant for late planting; separating the tubers is found desirable at that time.

In planting the large tuber, one forgets the rule for depth according to size, but plants the long tuber vertically with the shoot-end not far below the surface. It is necessary to see that dormant buds on the stem-end are provided for each section in separation; blind tubers will be a disappointment.

While favorites must be held by tuber-planting, it is very interesting to grow a lot of seedlings, and some beauties are likely to be had. Sow the seed in boxes in the frame or greenhouse, as heat increases in February or March; plant out the seedlings after all danger of frost is over; keep them going with water and shade if the summer heat is high and bloom will be secured the first autumn.

Although we have grown our plants in self-sustaining clumps, it is better perhaps to give them more attention by removing surplus shoots and training the best shoot to a stake; topping it at about two

feet and encouraging branching from this tree-like basis. A high stake and firm tying to it are a necessary precaution against wind injuries.

Freesias.—These are really the most joyful little bulbs known to us, and they seem ready always to winter-carpet your place and to give it the odor of a perfume factory. If you make a start with autumn planting as soon as the ground is deeply moistened by the rains, or if you wet down by irrigation if rains are late, growth begins early, flowers appear in the early winter and after that the plant holds possession and extends its area wherever the little bulbs are scattered by cultivation or otherwise. These are the white freesias which are chiefly grown, though others are coming into notice. They require no particular culture-methods; they seem willing to accept all rules or to thrive without any. The flowers have more delicate coloring in partial shade.

Gladiolus.—Gladiolus is of two quite different types and cultures: the "early" or "small-flowered" type, which is hardy in California autumn and winter and therefore belongs to "bulbs for fall planting"; and the large or standard, older type which is planted later for midsummer bloom. Each is grand and desirable in its own way and California notably pleases both of them.

The early-flowering gladioli, the old "Bride" type followed by Colvillei creations, are graceful and beautiful for boquet or small vase clusters and should be planted in the autumn, with succession into early winter, for they make good winter growth for spring performance. The late-flowering sorts need more heat in the soil to push activity and prevent decay and should be planted after the soil warms up through increasing sun-heat and freedom from cold rains. The improved late varieties make stalwart stems of gorgeous large flowers and are best suited for midsummer garden display or for cutting for the grander style of decorations. In light, warm soils they may be planted as early as January, but in most places later planting is better, and it may be continued until June to get a succession of bloom.

Gladioli enjoy the best one can do for them in soil preparation, fertilizing with old, cool materials, and generous moisture. The large sorts need light staking, for they blow over easily when reaching their greatest weight of flowers, and as they have to make their race in summer heat and drouth, a ground cover of light litter described on page 58, keeps the surface moist and relatively cool, as is desirable in midsummer. In cutting the flower stem the leaves should be allowed to remain for their service to the bulb, as previously stated in this chapter. It is especially mentioned here because it requires some effort to separate the flower-stem of a gladiolus, but it should be done. After the top growth has fully dried, the bulb should

be lifted and dried well before storing for the winter. This can be done easily by leaving the top growth attached to the bulb and piling loosely under a tree or in an open shed. After this drying, cut off the old leaves, separate the bulblets and store the bulbs and bulblets separately for convenience in replanting. At planting time reset the bulbs in proper blooming form and sow the bulblets thinly in a shallow trench, for easy cultivation and watering as needed. In this way many of them can be brought along in small space for their blooming in their second or third year. In this way one can soon have all the ready-to-bloom bulbs he can find space for.

Probably no flower has recently been more actively worked with for new magnificence of bloom than the summer-blooming gladiolus, and every amateur grower should keep track of the latest offerings by the bulb dealers. The amateur can grow seedlings from the newer strains of seeds which are offered and get much joy out of it perhaps, but there is little chance of catching up with the professionals. It can be done as suggested for dahlia seedlings, but one need not fear frost as much. It also takes two or three times as long to get a bloom from seed and there is more chance of wearying of it.

Hyacinths.—Hyacinths are of two general groups: the Roman, which shoots several small clusters of flowers, and the common or Dutch, which gives one large, cylindrical cluster of single or double flowers. Hyacinths are probably better as potted than as open border plants and are more important commercially that way. Many who plant in the open are disappointed in shortness of the bloom stem or in imperfect development of the cluster. Undoubtedly a part of the disfavor which hyacinths incur as garden flowers is due to late planting and other influences which cause the top-growth to develop before good rooting is secured. If planted quite deep, say not less than four inches in a well drained soil and planted in October and November, there is likely to be a much better root-development than if planted a month or more later, which seems to hasten top-growth too much. Probably another reason for disfavor out of doors is the fact that they bloom at the season when the winter rains are apt to be most heavy and continuous, and a rain-bedraggled and splashed hyacinth bed is a rather sorry sight. Still when planted right and mulched to reduce splashing and the rains light at their season, hyacinths do produce a grand effect and one will find enthusiastic supporters as well as impassioned critics of the flower. On the whole the Roman are more popular than the Dutch: they pretend to less and they accomplish more, usually; and of the Dutch, the single lead the double in favor.

Hyacinths should not be expected to repeat bloom in place, and it is probably true that it is not worth while to try to save the bulb at all, but to buy new ones each year from the professional propagators,

although it is interesting for each grower to determine his own policy in that line. The bulbs should be taken up after the foliage dies down, the rubbish removed and the bulbs stored in a cool, dry place.

Iris.—The Iris family is now becoming more popular every year and should receive more attention. From year to year new varieties are introduced. The colors are very numerous. They are perfectly hardy; they can be cultivated in shady places where other plants will not thrive; and some of them will thrive in any kind of soil and without much attention, although they will show you that they appreciate it. The English, the Spanish, the German, the Japanese and the California iris, all of them are well worth cultivating by any one who will make a study of their several needs.

The commonest is the German iris—the "sweet flag" of our grandmothers. It does grandly in California if it is helped along through the dry season, which is strange to it, for it is a humid-summer affair. It makes winter growth in most parts of California and flowers correspondingly early in the spring. Too much attention is evidently given to the old suggestion that the German iris should rest in the California summer, as it does in the eastern and European winter, and plants are allowed to get into distress during the dry season on the belief that it is good for them, which we are quite sure it is not. To allow the leaves to burn dry and the surface, fleshy roots to bake, not only gives the plants a perishing look but injures them also. This group of varieties, which range from pure white to deep purple, should have a little moisture in the dry season; the roots crowding upward should be lightly covered with soil or mulch, and the plants should be taken up and divided at long intervals at least. Old run-out clumps, which have lost force enough to bloom, will be refreshed by division and replanting and the roots will soon break into bloom in the new places.

Contrasting with the broad leaves characteristic of the above group are the Spanish irises, so-called, which have narrow leaves, almost grass-like in aspect and not abundant, and stems so thin that one is apt to wonder where such grand clusters of flowers can come from. These irises entirely disappear some time after bloom, break through the ground early in the rainy season and bloom in the spring gorgeously, the colors running through blues and yellows to clear white, and there are mottlings and stripings which are very beautiful. These varieties enjoy the full sun and dislike too heavy shade.

The Japanese irises are perhaps the most difficult to grow of the lot and more are disappointed with them. They are, however, so fine that no one should be content not to try them. The flowers are very large and the colors are rich and various. Perhaps some failures of this group have come through too great neglect after blooming,

resulting from too rigid application of the rest-doctrine. They should have good treatment of the soil surface and not be allowed to dry too much during their dormancy. Sometimes the roots suffer in shipment and become unsound. As for soil, it is particularly necessary that it should be finely prepared as described on pages 27 to 31; both the German and Spanish will not be so insistent on this.

In transplanting irises there is much latitude in different parts of the state. Fall planting is admissible everywhere if the soil is permanently moistened. At the south it is particularly necessary that planting should be early in the rainy season, for there is less winter moisture in that part of the state, and an early establishment of the rooting is almost indispensable. In more northerly places with heavy rains and lower temperature, one can either plant early and get the advantage of the autumn heat or wait until early spring. The rhizomes or roots should be planted about a foot apart in rows or otherwise, leaving more distance for cultivation between the lines of plants when one is growing many plants for cut flowers.

Varieties of iris in all the groups mentioned, and in others also, are beyond enumeration. All the florists give attention to them and furnish inspiring descriptions. California has at least one iris-specialist, Mr. J. Dean of Moneta, Los Angeles County, with whom all intending enthusiasts on the iris should correspond.

Ixias.—These are small and very interesting flowers of a wide range of colors—pinks, reds, yellows and white with variegations. They are early in action, like the freesias, but are very different in effect, with their showy bloom held high on stiff stems. They are treated like freesias and are quite as grateful.

Lilies.—California is rich in native lilies which have become famous all over the world, and most of the foreign lilies have been introduced to our culture. These various lilies have natural conditions somewhat different, but the amateur can successfully grow all he cares for of them under about the same artificial conditions. These would be a well-enriched soil of considerable depth, of such open character as favors drainage, soil-covering to prevent drying and over-heating of the surface; and in the hotter parts of the state, some shade against sun-burning—and always enough water, more particularly for the later bloomers. A lily bed can well be given much care in preparation, for it is to remain undisturbed for years. Lily bulbs should be moved as seldom as possible, and for this reason they must be protected from intrusion of gophers, which are very fond of them. Methods for doing this are given on page 190.

In making lily beds the ground should be spaded very deep and abundance of well-rotted manure worked in. The bulbs should set

at least four inches deep, and planting in sand, as suggested on page 187, is desirable. In sandy soil deeper planting is of advantage. But under no consideration use green manure on lily beds or bulbs of any description. If lilies are to be grown in beds for cutting, it is convenient to make them about three feet wide and as long as desired. But rather a better effect can be secured by planting in clumps with perhaps a dozen bulbs of each variety in a clump by itself. It is better to have fewer kinds and mass them in this way than to have only one or two each of many kinds scattered here and there. The lilies look well and are protected from the winds if planted against shrubbery background with tall trees south of them, so that they are on the northern exposure—this suggestion being of increasing value in the hotter parts of the state. As the bulbs are deep, the surface of the bed may be lightly forked between growths, and surface application of well rotted manure made from time to time. After flowering the beds will need little water if thus protected from surface baking.

Lily of the Valley.—Lily of the Valley is considered very difficult to grow except under artificial conditions of moisture and shade, such as can be had under glass. In the central coast district fairly satisfactory results can be had with lilies of the valley grown on the east side of buildings, fences, etc., while they would fail if placed on the south and west sides of these barriers, where the springtime heat may become very high and the air very dry. The bulbs or roots come in two distinct conditions, in single crowns, called pips, and in clumps. The pips are imported for forcing purposes, and they probably cannot successfully be forced without artificial heat, and even under this treatment they are first subjected to a freezing point. This makes the pips not very satisfactory to the amateur, and, although thousands are sold annually to amateurs on account of their cheapness, disappointment is general. Clumps are necessary to insure success to the amateur. They flower in due time and if bedded out in a sheltered, partially shaded situation, with proper care they can readily be established and produce their flowers from year to year. But they must not be allowed to dry up completely; they must receive at least a moderate supply of water throughout the entire summer season.

Montbretias.—Montbretias, or perhaps more properly tritonias, are a very easily grown and satisfactory plant with foliage resembling a gladiolus and flowers of similar style, but small and because of yellow and reddish coloring, very showy in contrast with the light green leaves. The small bulbs are planted early in the rainy season, the plant starts in early spring and makes a midsummer bloom. The bulbs multiply with great rapidity and clumps or rows rapidly widen. The plant needs ample summer moisture or the foliage becomes rusty and unhandsome even before the bloom appears.

Narcissus.—Of all bulbs probably those of the genus narcissus are most abundant in California gardens and give amateurs most pleasure. Daffodils of all sorts, China lilies, jonquils and those which use the family name as poet's narcissus, trumpet narcissus, etc.—all belong to the botanic genus, narcissus. They come from all parts of the earth and they are all at home in the California winter. They thrive with the most ordinary care and culture and show a disposition to run wild in the fields, as the bulbs chance to go with garden rubbish. They have a long blooming season, for the natural habits of the varieties differ; there is much length to the planting season and the haste of the flower after planting is determined by local soils and exposures. Certainly one could have daffodils for nearly if not quite half the year if he should distribute varieties and planting dates and use both warm hillsides and cool bottoms for his venture.

Narcissus varieties accept natural soil conditions in all parts of California, but their growth is enlarged by generous manuring. As their activity covers the rainy season, they seldom need irrigation unless it be to facilitate planting in September, or to awaken the old bulbs for early flowering, when fall rains are delayed. Cultivation helps them also and it is at least kind to mulch the soil with the dried top-growth, after it dies down, or to otherwise check the baking of the ground as described on page 189. But they will not resent neglect, but will break through hard ground and, if the following year is one of abundant rains, will apparently forget all hardship. The bulbs need not be taken up, although they are not disturbed by it as lilies are apt to be; they can be left in the soil for several years together, always making new bulbs until the clump is so compacted that the bulbs become flattened like chestnuts in the burr. The clump should be lifted and the bulbs reset on new ground, or on the old ground well manured, before such extremity is reached.

Of the narcissus family, Narcissus polyanthus, or bunch-flowering narcissus, are very early, and some of them can be had in bloom by Christmas if planted in September and kept watered. Some of the most popular of the bunch-flowering are the Paper White, the Chinese Sacred Lily, the double Roman, Grand Monarque and others. Probably the trumpet daffodils are the most popular of the narcissus family, and they are individually most beautiful and produce the most striking mass-effects in growth and for decoration. They come later than the bunch narcissus; most of them produce only one flower to the stem. The striking size and coloration of the trumpet group is a notable achievement. Jonquils are excellent for bedding purposes. They require very little care and succeed well in any fair soil. They are sweet scented and give general satisfaction.

Of varieties the bulb dealers are always presenting something new and interesting, and at the same time somewhat baffling to the be-

ginner for multitude. Mr. J. H. Howard of Los Angeles names a group of dependable sorts with which even the beginning amateur may be assured of success, and it covers practically all types from the giant trumpet forms to the polyanthus or bunch-flowered class, as follows: Emperor, Empress, Bicolor Victoria, Barrii Conspicuus, Campernelle Rugolosus, Horsfeldii, Golden Spur, Mad. Plemp, Orange Phoenix, Princeps Maximus, Soliel d'Or and Von Sion.

Oxalis.—These little, low plants with their rich clover-like foliage and delicate but warm colorings are very effectively used as edgings or in small masses. They are very eager to start and should be planted in August or September on well-moistened ground with partial shade to get good results. They will remain long in place in a shady exposure and awaken with the first rains. They are very sensitive to drouth after they start growth.

Ranunculus.—These bulbs or roots are analogues of the spring or herbaceous anemones and are grown at the same times, by the same methods and for the same purposes. They have, however, notable color differences and are generally associated with them for mass or line effects. The roots are like anemones and receive the same treatment.

Sparaxis.—Sparaxis or "wand-flower" is of ixia style and botanical connection and similar in culture requirements. There are many varieties, differing in size, colors and markings, and those chiefly propagated are very desirable. They are very gay and beautiful.

Snowdrops.—Snowdrops appeal to us as the best of the earliest bloomers—coming in December when established in the ground and awakened by September watering. Their snowy, bell-shaped flowers beautifully marked with green shyly peeping from the dark green foliage are very attractive. They are very refined and graceful on the mantel or the corsage. The bulbs are small and should be set about two inches deep and four inches apart in lines so that they shall not be forgotten during summer cultivation. They will remain in place for years and then thrive better after separation.

Tigridias.—Tigridias are striking in their colors and markings and notably interesting in spite of the short life of the brilliant cup-shaped bloom. If the soil is light and suitably prepared they may remain in place. The blooms keep coming for several weeks in warm weather. The bulbs should be covered about three inches in light soil; otherwise shallower, and distance apart may range from four to eight inches.

Tuberoses.—These superlatively fragrant tube-like bloomers come very freely and of grand size if the bulbs are set in light soils in warm exposures. Their growth in the light loams of the interior valley when kept amply moist is simply surprising and in such places can be left in the ground. They do rather poorly in lower temperatures and

heavy soils and need lifting after blooming, to be reset after the ground becomes warmed in early spring.

Tulips.—One can make the tulip story very short, unless he goes into the trials and tribulations of a generation of growers who made such various and protracted efforts to get some satisfaction from the old-style common or Dutch tulips. Some few have succeeded and produced notable results by planting northward of fences or buildings or under trees, so that only a fraction of low-power sunlight reaches them. In this way they develop slowly and the bloom-stem is not invited to shoot before root-force is accumulated to give it long distance. Even this policy does not avail where winter sunshine and warm air heats even shaded soil surfaces. Probably no one gets better Dutch tulips than Mr. Carl Purdy of Ukiah, and though he is a most discerning grower, we have always had the conviction that a part of his success was due to climatic conditions working with him in his coast situation north of San Francisco. But of course these conditions do not settle the question one way or the other. We, too, have worked in the coast district but, through careless practice probably, have always had these old Dutchmen sitting in the dirt like an egg in an egg cup. For this reason we quite sympathize with many who believe that the ordinary working amateur should drop all the old Dutch classes which have made such a sensation in the world. This of course does not mean to submerge all Holland, for Holland grows newer classes also, and until we get to commercial bulb-growing on this coast, as we should, we are greatly beholden to the Hollanders.

All tulips, so far as we know them, require in this state some shade against extra-hot spring days, for we often get, in the coast district, March heat which is even higher than midsummer heat, and this distresses tulips. All tulips also require lightness in the soil and all that is said of the beneficence of sand, manure and fibre on pages 27 to 31 should be deeply written on your tulip-conscience. Cool cow-manure is the delight of tulips and they should have it above their heads and under their feet. Tillage and ample moisture, unless freely supplied by the rains, are indispensable, as emphasized on pages 35 and 36. If one will give heed to all these things, he can surely have gorgeous tulips, stems knee to waist high, holding aloft great bells to ring joy deep into your heart—bells that will cause the meanness in your spirit to exult a little as your neighbor declares that he could never get a tulip good enough to put in a wine-glass, while yours seem to require an umbrella-stand.

This you can do by observing the cultural preparations cited and by growing the classes of tulips which are later flowering than the old Dutch and which are commonly called Darwins, Gesnerianas, Cottage and May-flowering tulips—the family entanglements of which we shall

not try to explain. but these are the ones for the amateur to grow. Other conditions of success are to plant early, usually in October or November, when the ground is right, setting the bulbs about four inches apart in the row, with hoeing space between the rows, unless you are trying to get all that you can from a small space or general effect from massing, and then the bulbs can be set four inches apart each way. To see just what you are doing and to give greater mellowness to the soil, it is a good plan to throw out all the dirt to a depth of about seven inches, spread a little well rotted manure; put a thin layer of sand or light soil over it; set the bulbs in this and cover lightly so as to place about three inches of soil over the top of the bulb, and then spread a mulch of light manure so that the heavy rains shall not compact the surface. If this is done one will surely get grand tulips of kinds which enjoy being in California. Much work is being done by propagators of these good tulips and improved varieties are almost annually appearing; therefore the florists' announcements must be carefully studied and one must always watch the results of those whose tulips show that they grow them aright.

Watsonias.—Watsonias make tall foliage and shoot long bloom stems, thus having something of the aspect of the gladiolus, with which they are somewhat allied. They have a more continuous blooming season, from spring until autumn, and the flowers are very showy. They enjoy much sunshine and are very popular in Southern California. They need early planting, say in September, on properly moistened ground, for the roots do not enjoy being out of the ground, and they may be allowed to enjoy it for several years as daffodils are, replanting when they crowd each other. If planted early they will lead the spring bloomers and be in at Easter in warm-winter places. It was of one variety of Watsonia that someone said: "It is the whitest flower that grows."

CHAPTER XIX.

FLOWERS FOR HOT, DRY REGIONS.

That the reader may have some relief from the continual reiterations of the culture exhortations which the writer has found befitting the greater areas of the California coast and valley regions, and in the hope of helping those who live where extremes of heat, cold and drouth are more marked, this chapter will be constructed chiefly of conclusions reached by Professor J. J. Thornber, while he was serving as botanist of the Arizona Experiment Station. There are very large districts of California which lie south-eastward of the Sierra Nevada and eastward and northward of the high mountains in Southern California, which are characterized by conditions unaffected by ocean influences and therefore more closely resembling those prevailing at the same latitude in the interior of the continent. In such districts Arizona experience is more pertinent than that of the coast region of California. It may be noticed, however, by the close reader that there is a resemblance in kind between the recommendations drawn from Professor Thornber and those previously given, but there is considerable difference in degree.

Growing the Right Plant at the Right Time.—A lack of appreciation of the differences between the winter, spring, and summer growing seasons is responsible for the failure of many plants, particularly flowers, to make any growth whatever when planted in the interior regions. Too often we are sowing sweet peas and poppy seeds when we should be planting petunias and zinnias. Some endeavor to grow the same varieties of flowers in the southwest in the summer season that they did in the states farther north and east, and in this they almost invariably fail. The experienced southwestern truck gardener, with his acre of rich valley soil, knows well not to waste time trying to grow such vegetables as onions, peas, and spinach during the extreme summer heat, though these conditions are perfect for some kinds of beans, for squashes and sweet potatoes. Species growing remarkably well during the winter and spring months are seldom able to make any headway in the summer season. In fact, such plants usually die at the beginning of the hot, dry fore-summer, or at least cease growth and production of flowers and seeds, even with moderate irrigation. Fruitless attempts are often made, on the open plains or valleys, to grow sweet peas, ten-weeks, stock, candytuft, crimson flax, or even California poppies in the summer. And the reverse is likewise true, for such varieties as flourish during the hot weather, seldom make any growth worthy of note in the winter season, and usually

they are not at all in evidence, having been cut down by the frosts of late fall.

Winter and Spring Bloomers.—As concerns annual flowers for late winter and spring blossoming it is true in general that varieties listed in seed catalogues as "hardy annuals" are the ones most certain to thrive during our so-called winter months. This group is made up largely of such well-known plants as mignonette, candytuft, sweet alyssum, sweet peas, sweet sultan, ten-weeks stock, snap-dragon, pot-marigold, common parsley, annual or rocket larkspur, and corn and opium poppies. To these may be added also the equally hardy arctotis grandis, crimson flax, perennial flax, blue lupine, annual phlox, Mexican evening primrose, California poppy, and the gaillardias—the last six of which are indigenous to the Southwest. Along with these should be planted, for spring and early summer flowering, the biennial foxglove, Canterbury bells, and the ever-present and hardy hollyhock.

Seeds of the above plants may be sown any time in September or early October in ordinary, well-prepared garden soil. When sown in September the young plants grow to some size by late fall, and are less subject to injury from birds and grasshoppers. The plants require only moderate irrigation during much of their growing season by virtue of moderate temperatures, and of the winter rainfall which at times is sufficient to supplement a considerable part of the watering. With a few exceptions, including the biennial species, the growth of these varieties is at an end by the middle of May when the hot weather sets in, after which many have little inclination to look after beds of flowers, while still others seek cooler climates. These winter and spring growing plants are accordingly well suited to the interior country and with the perennial species to be noted next should come to be widely grown. It is to them that we must look for cut flowers and diversity of color during our growing winter seasons when the landscapes in other countries are bleak and sere.

In addition to those mentioned, certain of the annuals, as phlox and larkspur, will continue, with cultivation and frequent watering, to blossom well into the summer season. No other of the winter growing plants supply so many flowers for cutting, nor so wide a range of color as the sweet pea. They should be given deep, rich soil and moderate irrigation, the latter in particular, after the first flower buds appear.

There are a few perennial species blossoming in winter and early spring that should be planted at the same time as the annual flowers just noted. Of these the well-known violet is one of the most satisfactory. Besides blossoming freely during the winter, with moderate watering it remains green throughout the year, and even if allowed to go unirrigated two or three months in the summer a fresh growth

starts up in the early fall, from the underground stems. Violets should be re-set about every second year to keep the roots from becoming too matted, and also to renew the soil. The usual custom of planting winter growing plants like the violet in the springtime is not good, as such newly-set plants require constant watering throughout the summer to keep them from dying. Far better it is to set them in the fall just as growth begins naturally. This is a safe rule to follow with all plants.

The various kinds of narcissus furnish excellent cut flowers for winter and early spring, though they are often shy bloomers. The more common of these are the Chinese sacred lily, poets' narcissus, trumpet narcissus, paper white narcissus, common daffodils, and jonquils, though several others of the group do equally well. September and October are also good months to set out such other bulbous plants as the star of Bethlehem, Roman hyacinths, the several varieties of oxalis, and the ranunculus. The latter furnishes an abundance of bright-colored, daisy-like flowers. Irisis represent another group of valuable spring bloomers. The German iris is planted more than any other, and always with good results. A clump of these plants is a feature in any spring landscape. Though remarkably tolerant to arid conditions the German iris does best in deep soil with an abundance of moisture. A somewhat similar though less showy plant, is the sweet flag iris. The Spanish iris also does well. Bulbous species like the above, and perennials in general need little attention when once established, but continue flowering in season year after year. For this reason they are more economical in the long run than annuals which need re-sowing, though the latter make a quick showing which is always desirable on new grounds.

Carnations, verbenas, and periwinkle or trailing myrtle, likewise are best planted in the early fall. Carnations in particular, should be given a moderately well enriched, sandy loam. These and verbenas are nearly continuous bloomers at the lower altitudes, while the varieties of periwinkle are evergreen trailers, with blue bell-shaped flowers appearing in the spring. Periwinkle is a general purpose plant, growing almost wherever planted, and thriving in both poor and rich soil, and in shade and sunlight.

Varieties for Summer and Fall Blooming.—On account of heat and aridity, only the hardiest garden plants will grow through the summer season with any degree of success, and even these require frequent or moderate irrigation. Of the annuals the following have been found to be the most successful: zinnias, globe amaranth, prince's feather, cockscomb, hyacinth and scarlet runner beans, golden feather, summer chrysanthemums, cosmos, asters, four-o'clocks, castor beans, garden sunflower, balsam apple (Momordica), cypress vine, and the various

morning glories, including scarlet, blue and purple flowered varieties, also Japanese morning glory and the moon flower. The seeds of the above should be sown at the lower elevations by the middle of April, and preferably two weeks earlier, in order to give the young plants a good start before the beginning of the hot weather.

Of the above, asters and cosmos are the most desirable for cut flowers, while for color and display, zinnias, globe amaranths, and four-o'clocks rank among the first. Asters, summer chrysanthemums, golden feather, cosmos, castor beans, and the morning glories are least resistant to drought and should be watered twice a week during the drier parts of the summer; the others are robust, deep-rooting plants succeeding with ordinary care, i. e., irrigation once a week or thereabouts. Morning glories are very much at home and may be sown any time from April to August. As herbaceous climbers they have few equals. They range from low bloomers with scarlet or sky-blue flowers to the tall-climbing moonflower. There are at least six native morning glories in Arizona in addition to the introduced ones mentioned. Balsam apple is a rapid growing, neat-appearing vine of the gourd family with delicate green leaves and orange fruits. The castor bean, like other rapacious growers and heavy feeders requires deep, rich soil and frequent irrigation.

Among the hardier of the rather few perennial summer and fall bloomers that grow successfully at the lower altitudes, are cannas, chrysanthemums, yellow, white, orange, and rose-colored lantanas, madeira vine, the native golden columbine, white and fairy lilies (Zephyranthes), and the so-called crown imperial (Crinum amabile), besides asparagus and lavender. Cannas are among the plants par excellence for display. Without fail, they should be re-set each year in early spring. Together with chrysanthemums and the crown imperial, cannas require good culture and frequent irrigation, otherwise it were best not to try to grow such plants. Columbines succeed only with partial shade and abundant moisture, while asparagus and lavender are among the hardiest of the list. When once established, fairy lilies need no further attention, and altogether are very satisfactory plants. Their lily-like flowers appear from June to October. Lantanas are unexcelled for southwestern planting, being continuous and profuse bloomers, though they should be cut back and given some protection during the winter season. The above perennials should be set out in the early spring—the earlier the better.

Varieties for Growing at Higher Altitudes.—Between altitudes of 3500 and 5000 feet, in Arizona and California also, where the lower winter temperatures approach zero, the hardy annuals are sown to best advantage in early spring, i. e., after severe freezing weather is over, while tenderer varieties should not be sown until danger from frost

is past. Perennials of whatever class are set out just previous to the time they ordinarily begin growth, be that fall or spring. With these slight differences in planting due to the cooler spring time all the varieties noted heretofore can be grown successfully at these altitudes—except in some places in northern California, where there is danger of frosts nearly every month.

Even at higher mountain elevations, however, there may be found frostless summers and one well defined growing season, and then spring planting is the rule. The conditions of growth are simpler and resemble those of the prairie states. As would be expected, hardy annuals succeed best at these altitudes since the growing seasons are invariably cool, though robust summer growers like zinnias do well. On the other hand, such varieties as cosmos, chrysanthemums, cannas, and castor beans are often frozen back in early September a short time after beginning to flower. Blue grass and white clover, and most annual and perennial flowers, appear entirely at home with the cool, moist growing season of the higher elevations, while at the lower altitudes of the interior regions with great heat and aridity the growth of most of these plants is practically impossible without adequate protection.

HINTS ON GROWING CACTUS.

On the dry plains of the interior one can surround himself with cacti and get grand flowers from them, if he knows how to handle the plants in propagation, transplanting and subsequent growth. The following practical suggestions are given by Eleanor M. Lucas, a California grower, who enjoys these plants and delights in a mild climate where so many cacti may be grown in the open ground.

Rooting Cactus Cuttings.—Make a clean cut. Heat an iron redhot (the poker will answer our purpose and it is the handiest tool for a woman to use) and sear the cut edge until it looks white and dry. Have a seedpan or box of coarse sand. Do not make the mistake of sifting the sand—this may cause it to "pack," and being close is liable to cause decay. If you cannot obtain coarse sand, mix with the sand some broken charcoal or bits of granite or other rocks. Do not use broken pottery—it holds the moisture and anything of the kind will induce decay. Have plenty of this drainage stuff in the pan or box; one-third is not too much. Water the sand until it is damp, then make a hole, insert the cutting and press the sand closely about it. Let it alone for at least three days, placed in the sun. If at the end of this time the sand is very dry, water slightly. One cannot give explicit directions for watering, as climatic conditions vary. Better err by keeping the cutting too dry than by giving too much water. Under good conditions a cactus cutting will root in two weeks, and at the

end of the third week will throw out new shoots, or new spines, as the case may be, and will begin to grow. Then transplant, following directions given below.

Transplanting.—For plants with roots, cut off all the dried roots when you receive the plant. If the plant is bruised, sear it with a hot iron, or dust with powdered charcoal. If the roots are bruised, better cut close to the plant, as they will decay anyway and you may lose the plant in trying to save one or two roots. Insert in sand, as for cuttings, until the roots are growing, then plant, always remembering to water sparingly until well established.

Soil and Care.—People who write that "cacti require no care" must have the Echinopsis in mind. It is a plant that will endure the most arrant neglect, and fairly shames one into treating it with more courtesy. Its flowers are a joy, the white ones so perfect in their pure spirituality, and so delicious in their wonderful fragrance; and the pink blossoms are large and satiny, lined with an ethereal silvery sheen, its deep throat tufted with a downy fringe.

The soil in the cactus bed should be very loose and gravelly and well drained. Nothing is more fatal to a cactus than a poorly drained soil—they do not like wet feet.

While cacti will live in any dry soil, they are responsive to good treatment and proper soil. For general planting use a mixture of half sand and half clean garden loam. For Phyllocacti use one part well decayed manure to two parts of the above, and to each bushel use a 5-inch pot of clean lime. For large Echinocacti add to the mixture of sand and loam one 5-inch pot of crushed granite, and, if the spines are highly colored and the desire is to intensify it, add iron filings to the soil.

If the plants are kept in the pots all the year around, the cacti will derive much benefit from plunging the pots into the earth during the summer months. Dig a hole larger than the size of the pot, and four or five inches deeper; put in a layer of broken rocks; on this place the pot and fill up with the earth. Make the beds where the sun shines the hottest—the spines will be clearer and the blossoms brighter. When well established the plants will endure lots of water, always provided no water stagnates about the roots.

In localities where the soil is heavy and ill-drained, and it is desirable to bed cacti in the open, make an excavation near the center of the bed, about three feet deep and as large as possible. Put a layer of stones or old tin cans and such rubbish in the bottom, cover with straw or coarse manure, then fill in your soil, having the bed slightly elevated near the center, and a well-drained bed will be the result.

CACTI AND OTHER SUCCULENTS.

Very handsome beds can be made in hot, dry places by grouping cacti with plants of Mesembryanthemums, Sedums, Crassulas and other sun-loving plants. These succulent plants are well fitted to endure drought. Their leaves have few evaporating pores, so that they do not readily wilt, and the roots are not so abundant as to overcharge the plant with moisture during wet weather. As a rule they like a dryish soil and arid atmosphere better than a wet soil and moist atmosphere.

CHAPTER XX.

WATER-PLANTS IN CALIFORNIA GARDENS.

To show the wide range of possibilities which welcome the California amateur to garden work, we contrast the heat-and-drouth-cultures of the preceding chapter with the growth of plants in water. This is delightful gardening sport in California for two reasons: First, because we can grow in the open air gorgeous water lilies, for which, at the east and in most parts of Europe, costly houses of glass need to be provided; second, because if proper arrangements are made, the amount of water required is very little. Once on a time someone told our friend, Mr. C. B. Messenger of the California Cultivator, that by having a tight bottom to it "an aquarium and water-lily combination requires no more water than an equal area of lawn" and we presume that is not far from right; for, in the case of the pond, one has little to make up but the surface evaporation, while in the lawn he has the surface of the earth and all the surfaces of all the grass blades acting as evaporators—not to speak of the lawn-water which leaks away through the soil. However such a calculation may come out, it is perfectly true that one can grow aquatics in a very little body of water as will be shown below. It is also true that, in connection with our thousands of small irrigation reservoirs, there is a little ocean of idle water growing green-scum, water-weeds and mosquitoes, which ought to be set to work growing water lilies and gold fish. For although, in the drier parts of the state, we have fewer natural lakes and ponds than they have in humid regions, there is, nevertheless, a good deal of water standing around doing nothing; and it is also practical to get a lot of joy from some of the busy water in such regions, because it will require so very little of it.

How a Man Came to California to Grow Aquatics.—We have always wondered what kind of a goose all his old friends thought him to be, when, about twenty-five years ago, Mr. E. D. Sturtevant, who was then the most prominent eastern expert on water lilies, etc., came to a semi-arid country to grow aquatics! But it does not matter much what they thought, for he soon showed them he was wise, because he could do so many things in the California open air which he always had to measure by acres of glass and carloads of coal in his old home. Of course he made a good location for frost-freedom and located in the old Cahuenga Valley, where they used to grow pineapples, string beans and tomatoes in the winter without protection—before the valley became the delightful Hollywood section of Los Angeles. And he also always found water enough for his aquatics in spite of the light rainfall and the increased appreciation of it engendered by the strong

prohibition sentiment prevailing. And so it came about that he was soon flowering the queen of the tropics, the Victoria Regia, in his water-yard in the foothills of the Cahuenga Valley. Of course that does not mean that one can do that everywhere in California, but beyond that Mr. Sturtevant's experience and that of others who have taken cue from him, does show that good water lilies and other aquatics can be had without glass or coal in this state if one will provide the few things required, as Mr. Sturtevant will outline for us in the paragraphs which follow:

Soil.—The majority of aquatics are gross feeders, and it is well nigh impossible to make the soil too rich for them. It is not necessary to go to a swamp or a natural pond to obtain what is suitable. It can be prepared upon your own premises. Any soil which will grow good vegetables will, if properly enriched, grow aquatics. A compost consisting of two-thirds good soil and one-third well-decayed manure, with a liberal sprinkling of bonemeal, is what we recommend. If you have a black, friable loam, which is intermediate between adobe and sandy loam, it would be excellent for the purpose.

Ponds.—The simplest arrangement for growing water plants is a large tub or half hogshead, partly filled with soil and located in a sunny position. A much better plan is to make a small pool by excavating the ground about two feet and covering the bottom and sides with concrete and cement. In a basin eight or ten feet across quite a variety of plants may be grown, using wooden boxes or shallow tubs to hold the soil. Those having fountain basins in their grounds can utilize them in the same manner. It is not necessary that there should be a continuous flow of water; but during the growing season enough should be run in each day to prevent stagnation and to keep the plants in health. While most aquatics will flower freely in contracted quarters, they will attain greater perfection with much larger flowers if they have abundance of room both for the roots and the leaves. Basins twenty or thirty feet in diameter or even larger than this are desirable for growing a good collection. In growing the lotus in the same basin with nymphæas, care must be taken to confine the roots of the former to a given space, as it has the habit of spreading in all directions.

Locations.—It might seem at first thought that California, being such a dry country, the conditions are not favorable to the culture of water plants. But our city gardens are supplied with water in the same manner as in the East. In the country the windmill is ever the ready servant; and where irrigation is practiced, nothing could be more simple than to turn the stream aside to irrigate a water garden. Natural ponds and lakes are rare, but a few such exist, and I believe

that they are suitable for the naturalization of the famous Egyptian lotus.

In the Eastern States we classify aquatics as tender and hardy. The tender kinds are, so to speak, bedded out during summer and removed to a greenhouse in autumn. During the last ten years it has been practically demonstrated that nearly all the tropical varieties can be successfully grown here and left out the entire year. In the Cahuenga foothills nearly every variety of importance has been successfully grown. I am writing of that place and those portions of the State which have the same climate; but for localities where frosts are frequent or severe, I would recommend that the more tender kinds be either removed in autumn to warmer quarters or else protected by a covering of glass or oiled cloth. I will give a selection of standard varieties with some notes on their requirements in this region:

Water Lilies.—The Victoria regia is the grandest of all aquatics. This most magnificent relative of our common water lily is a native of South America, and is named in honor of the Queen of England. From a seed the size of a pea it will, under proper conditions, in seven months produce a plant having a spread of thirty feet in diameter with perhaps eight or ten leaves each six feet across. The flowers are lovely beyond description; but the monster leaves of the plant are its glory. The flowers on good plants are twelve inches across, pure white, with petals more numerous than in the common water lily. They exhale a most delicious perfume, like that of pineapples, which pervades the air for a considerable distance.

The Victoria has been grown in the Cahuenga Water Garden with fair success for several seasons. Their first opening occurs in the evening, and the following morning the flower closes entirely, to open the second evening, when another wonderful transformation takes place. Every snow-white petal has assumed a deep pink color, and the flower has lost its fragrance. A new flower appears every four days.

Many other water lilies succeed admirably, their requirements being much less in every respect than the Victoria. These varieties are discussed and offered in the florists' trade publications. Some of these are the ones commended to the amateur for his small cultures.

The Lotus.—The lotus (Nelumblum speciosum), is a plant of remarkable interest and has been a favorite flower in Japan for a long period of time. It has proved itself to be equally at home on the western continent. We have had the lotus in cultivation in California, and it is worthy of all praise bestowed upon it. As to its culture, it prefers a heavy soil, well enriched. It may be grown in a large shallow wooden box, submerged in a fountain, or a more liberal space may be given to it in proportion to the size of your basin or pond. Those

who have adobe soil may make an excavation, taking care that good soil is replaced in the bottom; the tubers may be planted in this pool which should be kept flooded during summer. During the winter season, while the plants are at rest, the pool will require no water, except what is furnished by the winter rains. The roots are tuberous and shaped like bananas. If it is desired to transplant them it should not be done until the growing season arrives.

Other Aquatics.—There are many other aquatic plants which do not belong to the water-lily family, but which are both interesting and beautiful, and help to make variety in the water garden. Among these is the water hyacinth, Eichhornia crassipes major. It has swollen leaf stems, filled with air cells. The plant will grow floating around in deep water, but flowers most freely where its roots can take hold of the soil. The blossoms are rosy lilac, produced in large spikes. Eichhornia azurea, more recently introduced, has a creeping habit like a verbena, and flowers of a bluish color. These two plants do best if partially shaded from the full sunshine in summer, and sheltered from cold winds in winter.

Limnocharis Humboldtii, or the water poppy, has flowers of a lemon-yellow color, and somewhat resembles the California poppy of the fields. The plant prefers shallow water.

The Cape pond weed (Aponogeton distachyon), though not a showy plant, is interesting on account of the fragrance of its small white flowers and its habit of producing them in winter.

Ouvirandra fenestralis, the lace leaf or lattice leaf, has somewhat narrow leaves, about a foot long, which grow entirely under water. They are of an olive-green color, and consist merely of the framework or veins of the leaf with the fleshy part entirely absent, thus presenting the appearance of a beautiful piece of network or skeletonized leaf; hence the name lattice leaf.

Some aquatic plants, besides the Water Hyacinth, are found floating on the surface of the water, without attaching their roots to the soil. Pistia stratiotes, the water lettuce of Florida, is another, also, the Azolla or floating moss, resembling a beautiful moss or selaginella. This I have found growing wild in California.

The Environment.—Our water gardens have a background of semi-tropical trees and plants. How great an advantage do we here possess over those who live in colder latitudes, when we can use for this purpose such plants as the feathery papyrus, giant grasses, large-leaved caladiums, musas, the towering bamboo and a variety of noble and beautiful palms.

PART V: SHRUBS, TREES AND VINES.

CHAPTER XXI.

CHOICE AND TREATMENT OF ARBORESCENT PLANTS.

Obviously, it would be impossible in this little book to show forth the glories of all the shrubs, trees and vines which are found in California gardens and enjoyed by those who dwell between and beneath them. Even if the writer had adequate knowledge thereof, which he has not, the metes and bounds fixed for this publication render it impossible to show forth such knowledge. And the limitations of the writer are not unlike those of his readers. None of them, unless he should undertake the establishment of an arboretum to represent the capabilities of the state for arborescent growths and had, for the purpose, a few townships of land and millions of money, could actually enjoy sight of all shrubs, trees and vines which enjoy California habitation. Even the botanists, upon whom rests the burden of completeness in enumeration and description, can only discharge themselves of it by signs and wonders of condensation and identification which render their writing intelligible only to themselves—even when they fill great tomes with their beautiful inscriptions.

And then it is not wise for an amateur to try to know all plants. He may very properly make effort to know all of a botanical or floricultural group and get much satisfaction from his collection of facts and plants within the group which commands his interest. The effort will give him much real joy if he has leisure and funds to encompass his whimsy and become expert in it. But it is usually better for the amateur to find a few shrubs, trees or vines which he really admires and which show by their growth that they enjoy his company and conditions, and then let them both and all cling to each other until death doth them part.

A man should decide for himself what things he shall plant around his habitation and he should reach that decision by sight and not by hearing. He should find these plants in the same way that he finds a wife or a farm—by looking. Therefore we shall submit no lists of shrubs, trees or vines to be unthinkingly adopted. We shall rather undertake to name, and perhaps briefly characterize, a great many which are satisfactory in California, according to the data we have now in hand. Almost everyone knows something about such plants from sight, either recent or remote, and has reached some decision as to the style of a genus or a group which pleases him. The lists which follow will help him to knowledge of the behavior in California of the

plants named and to choose species or varieties which have accepted the conditions of his general region. This may help him to make a start, but we must urge upon every amateur to pursue shrub, tree and vine studies whenever opportunity offers. Walks abroad in his suburban situation will always give opportunities for such studies and so will rides along rural highways, passing well planted farmyards, or village parks, etc.—all of which have specimens worth looking at and talking about, unless one be a speed-burner, never seeing anything but the horizon unless he crashes into it. And then the many parks and pleasure grounds of the greater cities of California afford splendid material for study. In many of them due attention has been paid to name-labeling and from these public exhibits, plants which please can be noted as a guide in ordering from the nurserymen. At many of the nurseries also good growing specimens can be seen and information gained concerning them.

Choice and Arrangement of Trees.—Although we advise every planter to choose his own particular trees, there are a few hints of a general character which may be indulged in.

In dooryards of small area in any part of the state where the rainfall is great it is undesirable to plant evergreen trees because their shade excludes winter sunshine and keeps the place dark and wet—not only to the discomfort of people but to the exclusion of winter-blooming flowers which you might otherwise have. For the same reason, plus their somber aspect, evergreens of the coniferous class are also undesirable. If densely-foliaged evergreen trees are required for winter wind-breaks, plant them to windward, and if this be on the south, plant them far enough away so that they admit all the sunshine possible under your limitations. In sections where there is little rain and much sunshine, or on large places with ample side and rear spaces, indulgence in the wealth of broad-leaved evergreens which thrive in California is commendable.

Coniferous evergreens should not be planted in any position where the tree cannot be given full possession of the ground under its branches. Trimmed-up conifers are grotesque, as will be claimed in connection with pruning. If open space is desired under evergreens they should be of kinds which naturally make clear trunks in their early life, or do not adopt a set form which is destroyed by trimming up.

Although it is admissible to plant trees of different kinds together for reasonable variety in dooryards or to their rear or sides, it is not desirable to mix trees along driveways which are expected to have an avenue effect. This is especially true in street or highway planting. From lines of single trees multiplied, however, we get a distinct impression, and that impression is not due to any one of the trees,

but to their continuity. Each, for instance, may choose for himself which he prefers—the stateliness of palms or the grace of grevillias —and be sure of having something actual and effective. But where the palm and another tree of very different growth habit are alternated, the row produces no distinct impression whatever, except perhaps the suggestion of incongruity and conflict. Stateliness and grace are both utterly gone.

For the same reason tall trees should not be alternated with shrubs in an avenue planting. It is admissible in making a windbreak, for protection above and below, but then one is making a wall, not an avenue.

In districts of great rainfall deciduous trees should be planted along the highway, rather than evergreens, that the mud on the road may have a chance to dry in the sunshine. If there is a sentiment for evergreens, they should be restricted to north-and-south roadways. But do not attempt to meet this objection by planting deciduous trees on the south side of an east-and-west road and evergreens on the north side. It destroys the avenue effect entirely.

Whatever trees are selected for any purpose except the making of a hedge or windbreak, do not plant the trees too near together. If they are naturally large trees forty feet is close enough on inside driveways and fifty feet on the highway. Close planting with the expectation of removing alternate trees, prevents the trees from developing their natural beauty and gives a row of deformities later. In the planting of smaller trees and shrubs reason must be used in determining distance, remembering, however, that almost always trees and other plants are set too near together. They look so small when young that it requires strong resolution to space them properly. It is a good idea to decide carefully what space they can use to advantage when well grown, and then give them twice as much.

Growing Trees and Shrubs from Seed.—Although it is usually better to buy a thrifty young tree or shrub than to grow it, the latter can be done when one has more time than money, and it is a very interesting operation. Seeds of all the more popular trees can be cheaply bought from the seedsmen or may be gathered from mature trees in any neighborhood by looking for them at their season. One has to be careful to gather seed before the natural containers are sprung open; for instance, eucalyptus seed capsules must be gathered from the tree while the cap is still in place and allowed to dry on a sheet or in a box which will catch the fine seed as the dropping of the cap releases it. Acacia seed pods spring open on the tree and shoot out their seeds; cones with their scales apart have usually discharged the seed, etc.

Growing seedling shrubs, trees and vines is accomplished by the methods described in detail in Chapter VII. Growing and transplanting such seedlings involves all the outfit of seed boxes, frames and open beds there noted and the soil mixtures for tree seedlings are the same as for other plants, except that manure is sparingly used. It is not desirable to push a tree seedling as you would a blooming, ornamental or foliage plant. An over-grown seedling is apt to get a set back after putting in permanent place; a medium-sized, well hardened tree seedling is usually better than a large one. Although some trees transplant well when quite large, the growth should have been secured through longer, slower growth than by forcing too freely with manure and water.

Starting Hard Seeds.—Some tree seed has very hard and tough envelopment, as noted on page 62 with reference to acacias. Some seeds will not endure such hard scalding, but respond to less heroic promotion. Professor Thornber, whose line of experience is noted in Chapter XIX, obtained best results with such seeds by immersing in water at 185° to 190° F. for a period of two to six minutes, according to the character of the seed coat. Seeing that some seeds were injured by too long scalding he adopted the method of keeping in hot water for two minutes, then soaking in lukewark water from 12 to 24 hours; the swollen ones are removed and the unchanged ones treated again with hot water—repeating the scalding and soaking several times if necessary. Usually, however, this elaborate method will not be found necessary and many seeds of shrubs and trees will come readily after soaking in lukewarm water for 24 hours before planting.

Shrubs and Trees from Cuttings.—Many shade and ornamental growths come readily from hardwood cuttings, as described on page 67. Cuttings of eucalyptus, for instance, can be made of new wood of the thickness of one's little finger and smaller, providing the ground is kept continually moist by irrigation all through the first summer. From the many shoots which come, one is to be selected and others removed, to get an upright stem. Cutting of deciduous trees which root readily, like willows, cottonwoods, etc., can be made early in the rainy season. As a rule cuttings of evergreens need greater soil-warmth and do better after the cold rains of midwinter are over.

Budding and grafting ornamental trees is accomplished as described in Chapter VIII.

Planting Trees and Shrubs.—The principles involved in planting are the same for all plants and the outline given in Chapter XI is therefore applicable to shrubs, trees and vines.

Deciduous growths usually transplant successfully during their leafless season, except when the ground is full of cold water, and it is not necessary to take earth with the roots. In the case of very

large trees large masses of earth are handled with the tree wit
hoisting and hauling machinery, but this is a professional af
California this work is seldom undertaken unless one must
ready-made park immediately. It is less necessary in this state, now-
ever, because trees grow so fast and one can have very large trees
from very small ones in a few years if he takes good care of them.

Evergreen trees and shrubs should be transplanted, as nearly as you can decide upon it, when the new growth is about to start. This is when moisture and heat are adequate to growth. On the whole, the best season is from February to May, according to the region you are working in. Heat is then adequate and not excessive, and moisture is adequate. Everything feels like growing under these conditions and the tree quickly establishes itself. In places where there is a long autumn growing season, evergreens may often be handled near the close of a midsummer rest which they are apt to take. Evergreen trees and shrubs should usually be moved with a ball of earth. Dig a trench around the plant or along each side of the row of plants, about six inches away from the stems and a foot deep, pushing away the loose surface soil between the trees which has no roots in it. Then cut down with a sharp spade between the trees about as far on each side as the trench is from the tree. Use a very sharp spade so as to cleanly cut roots and not break the ball of earth. Then cut under the tree from each side at the bottom of the trench and you can lift out the small tree with a ball of earth enclosing its roots. If the soil is very friable, slip a piece of sacking under the ball, pull up the corners and tie at the base of the tree stem, and then the ball can be handled without breaking. Handled in this way, evergreens can be moved at almost any time of the year, though it is better to take them under conditions noted above.

Trimming and Pruning.—Treatment after planting is outlined on page 89 and general suggestions on shaping are given on page 90.

Ornamental and shade trees in dooryards, and particularly shade trees along streets and avenues should be allowed to take their natural forms as far as possible. There is one reason why pyramidal conifers should seldom be chosen for such places. The requirements of the street are such that the lower branches must be removed and a clear trunk secured. To remove the lower limbs of a pyramidal conifer is tree butchery, consequently trees which naturally make a spreading crown and a clear trunk should be chosen. Enough pruning must be done to raise the head so that the branches do not interfere with traffic and passage. It is emphatically undesirable that avenue trees should be cut back to an artificial form as fruit trees have to be. It is sometimes desirable to cut back or to remove branches which go astray, but there should not be regular pruning to make a form un-

natural to the tree. If low trees are desired choose those which do not naturally grow high. If dense shade is not desired, choose trees which naturally make a slim form, etc. It is to compass such knowledge that all readers are urged to know trees through observation, as already insisted upon.

Tillage of Trees and Shrubs.—Trees should have tillage and irrigation, in reasonable amount, during the early years, for the purposes defined in Chapter III. By such treatment one not only helps the tree to grow, which may not always be necessary, but proper treatment of the tree in its own space prevents it from encroaching so far upon space desired for other plants. A line of roadside or driveway trees may send its roots for rods and interfere with other growths because its own ground is hard and dry and inhospitable. Therefore trees should have their own proper treatment and rations. Besides, such trees should be forced to root deeply by digging which will destroy their surface roots when young. If this is done much of the space under the trees may be saved for shallow-rooting flowers which enjoy shade. If trees are allowed to appropriate all the surface soil in the vicinity, nothing else can thrive.

Tree-Surgery.—This kindly art has recently been developed into professional standing and one can telephone for a tree-doctor just as he may telephone for another kind to look after his appendix. It is therefore a matter passing amateur limits, but we venture a remark or two, nevertheless.

When it becomes desirable to remove a large branch always saw first from below upwards part-way through, so that the falling branch may not tear away the wood and bark below it. Finish the cut from above, and if you have not made a smooth cut, take off another thin slice. To ensure a good wound it is obviously desirable first to cut a little distance away from the trunk or larger branch and then saw off the stub cleanly. Do not leave a stub; cut just at the outer edge of the enlargement or collar at the base of the branch to be removed. Cover the wound with thick paint or coal tar, not allowing it to run over the adjacent bark, however.

Old trees from which branches have broken or have been carelessly sawed or chopped off should have the stubs cleanly sawed off and treated as above.

Whenever this has been neglected and whenever decay has entered the large branches or trunk from this or other cause, remove all the unhealthy bark, making a clean cut back of the healthy bark. Cover the exposed wound with coal tar, which had been boiled for a time and allowed to become cool. This boiling expels some of the volatile matters which might be injurious to the tree, and it also causes the tar to harden more quickly and to penetrate less. This will keep the wood

from decaying, will exclude insects and kill all which have succeeded in securing an entrance. If there is soft rotten wood under the bark, scrape out the cavity as clean as possible, removing all decayed wood. A carpenter's gouge is a good tool for this purpose. Then paint the inside of the cavity with coal tar which has been boiled—not pine tar. After drying, fill with Portland cement and smooth carefully around the edges. This will arrest decay and the bark will grow over, providing the cavity is not too large, or may remain exposed and be painted to resemble the bark color.

CHAPTER XXII.

SHRUBS APPROVED FOR CALIFORNIA GARDENS.

Without undertaking to learn what the systematists have decreed, for such rough classification as this work requires, the term "plant" will cover everything from a violet to a sequoia gigantea. When occasion arises for differentiation between the terms "shrub" and "plant," the term "shrub" will be applied to rather small growths of a woody character which in their natural development do not reach sufficient height to be called "trees." The height properly belonging to a shrub would normally be less than ten or twelve feet. Contrasting with this, a "plant" would be a vegetable affair which makes only soft or herbaceous growth, reproducing such shoots from the root crown or lateral roots, and never attaining a woody texture in these shoots. Height cannot be prescribed for "plants" because some soft herbaceous stems rise higher than some woody stems. The only reason for prescribing height for a shrub is to conveniently distinguish shrubs from trees, both of which, of course make practically the same character of woody growth, but "trees" project this growth more than ten or twelve feet from the ground and sustain it there without support. Whenever a herbaceous or woody stem reaches considerable extension, but cannot gain much elevation without support, it is a "vine."

California's Wealth of Shrubs.—A comprehensive discussion of the shrubs available for California gardens is beyond the writer's space and knowledge. It would be a charming subject to grow wise about and no doubt ere long some one, with proper botanical and cultural equipment, will undertake it. How broad is our natural suitability for shrubs of all climates may be inferred from the statements made on pages 8 and 9. It is a fact that a visitor from any part of the earth, except perhaps from tropical jungles, is likely to see in some California park or garden some flower, shrub, tree or vine which he has been wont to see at home and he may see it here better cared for and honored than at home, for both plants and prophets may have more honor abroad than in their own country. And that suggests a brief reference to the claim that California planters would show more patriotism and better taste if they should make gardens of plants native to the state and not draw so heavily on the world's flora. One statement of that claim is made by Mr. Wilhelm Miller, a distinguished esthetico-horticulturist of New York City, in these words:

"What gorgeous opportunity California has to work out a unique style of landscape gardening based upon her native trees, shrubs, vines, and flowers. It is one of the richest spots on the earth's surface in

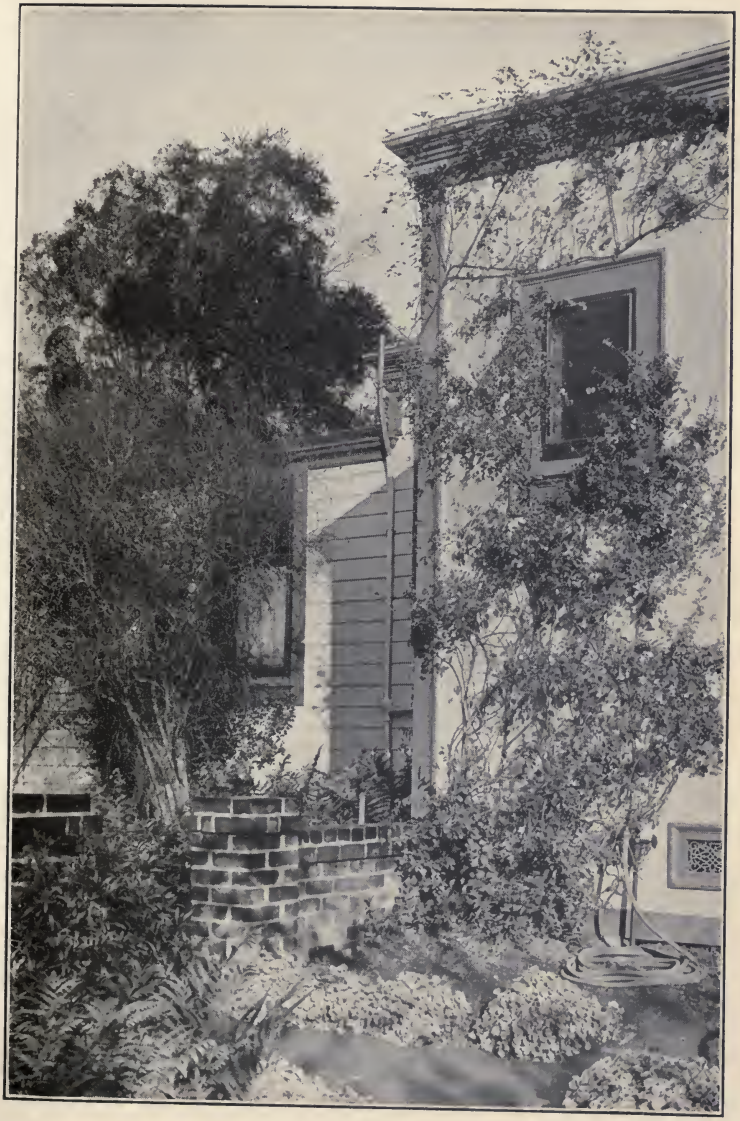


PLATE 10: "HELIOTROPES CAN BE CARRIED THROUGH FROST BY FLAT-TRAINING AGAINST THE HOUSE WALL"—PAGE 234.

variety of plants worth cultivating for their beauty. These plants, as a rule, will not thrive east of the Rocky Mountains, and this fact alone will guarantee California an appearance different from all the rest of the United States. * * * Surely the most cultivated people of California must realize that there is something more refined than miles of scarlet geraniums, acres of callas and millions of crotons and cannas. Think of the noble Monterey Cypress and all your pines, firs, and redwoods, which are the wonder and glory of the world. Think of your Christmas berry, a finer plant than the old world holly. Such plants and others should be dominant in California landscape and gardens, instead of the gaudy plants of foreign climes, which make California seem an imitation of other lands."

We are glad to admit the claim for the sake of those whose tastes may delight in the undertaking outlined, but as a principle of faith and practice in California gardening generally it does not appeal to us. California native plants are grand. They are worthy of all honor and of the increasing attention which they are commanding in our newer landscape architecture and in amateur gardening, but for greater variety of forms and more abundant color, for quick growth and development of bloom and for easy culture, we need to give increased attention also to the good things which come to us from the outside world. And it should not be forgotten that it is to California's adaptability to the growth of a great and diverse exotic flora, even more than to the unique style of her native plants, that the recognition of her difference from all the rest of the United States is due.

But while we cling resolutely to our miles of red geraniums and the multitude of other showy exotic shrubs which one will find in public and private places all through the valleys and mesas of the state, we do not undervalue the wealth of our native shrubs although we are not able to enumerate the items of that wealth. The reader who has thirst for that complete knowledge must seek it in the botanical treatises mentioned in the footnote on page 8. Others, whose desire is to know the most striking of the native shrubs which have already been employed in California gardens to greater or less extent, will be interested and edified by the compilation which we shall undertake from the writings* of Mr. Theodore Payne of Los Angeles, whose enterprise in making such growths available to planters is commendable:

SUGGESTIONS OF DESIRABLE NATIVE SHRUBS.

The California Lilacs.—There are many species of Ceanothus, which in early spring present a most charming appearance on many of our hillsides, with their long sprays of delicate, fragrant flowers, ranging

*Transactions and Proceedings California Association of Nurserymen, 1912 and 1913. H. W. Kruckeberg, Secretary, Los Angeles.

in colors from pure white, pale blue to bright and dark blue shades. They are propagated from seed, are of easy culture, rapid growth and particularly valuable for dry places. Ceanothus thyrsiflorus is one of the best known. It forms a handsome shrub with dark green shiny foliage and large panicles of deep blue flowers. C. crassifolius is a white flowered species, with rather rigid stems and opposite dentate leathery leaves. C. integerrimus is from a higher altitude, being found in the upper chapparral and pine belts. It often covers whole mountain slopes with its white blossoms, reminding one of drifted snow. It is a tall, loosely branching shrub with green or somewhat brownish stems and light green, slightly hairy foliage.

Southern California Sumacs.—Three evergreen shrubs especially desirable for their handsome foliage are Rhus laurina (Sumach), which grows in compact form, has reddish stems, smooth green foliage and clusters of small white flowers; Rhus integrifolia is especially common near the sea coast and has thick, leathery rich green foliage. R. ovata forms a magnificent shrub with extremely handsome thick, glossy green leaves.

California Buckthorns.—The Wild Coffee (Rhamnus californica) is well known and is a shrub which is in great demand. Rhamnus crocea is a low, thick, very densely branched shrub with small green leaves and insignificant flowers but producing, later in the season, quantities of rich scarlet berries. Rhamnus crocea var. ilicifolia is a form of the preceding but differs considerably in growth, forming a large, branching shrub of rapid growth with holly-like foliage and scarlet berries.

Evergreen Cherry.—A splendid shrub either for single specimens or for hedges is the Wild Cherry (Prunus ilicifolia). It has pretty, glossy green, holly-like foliage and small white flowers. Many specimens are to be found in some of the large gardens around Los Angeles and Pasadena and it is one of the most beautiful shrubs grown.

California Juniper.—There are many native conifers of value for dry-land gardening. There is one, however, which is particularly useful. This is Juniperus californica. It is found in some of our dry, sandy washes and is generally a dwarf spreading bush, but occasionally attains the size of a small tree. It has long been cultivated in Europe, and we could use it to great advantage in our gardens.

California Holly.—The Christmas Berry or California Holly (Heteromeles arbutifolia) is, of course, well known and greatly admired by everyone. It does exceedingly well under cultivation. Everyone knows its pretty foliage and attractive berries used so plentifully for decorating at Christmas time, but few realize its other attractions. An exceedingly fine specimen is on the grounds of ex-Senator Bard at Hueneme. It is truly a magnificent sight with its large trusses of white blossoms.

Monkey Flower.—Almost everywhere in our foothills can be found the bush monkey flower (Diplacus glutinosus). This shrub grows from two to five feet high. The flowers remind one of an azalea and are usually of a deep rich orange color, though other forms are frequently found, sometimes of a pale creamy white and occasionally of a dark reddish brown shade. This plant lends itself particularly well to cultivation, and if watered will bloom almost the entire year round. Diplacus puniceus is found near San Diego and is of similar habit, but has crimson scarlet flowers.

Atriplexes.—We have two native Salt Bushes useful for single specimens, or perhaps more particularly for hedges. Atriplex breweri is common along our coast. It is easily propagated from cuttings and grows rapidly and can be trimmed into a solid hedge. The leaves and stems are of a grayish-green color. This plant has been cultivated very largely in Santa Barbara and has often been spoken of as the "Santa Barbara Salt Bush." Atriplex canescens is a desert species and is desirable, both on account of its larger and more silvery foliage, as well as its large, panicled spikes of conspicuous rose colored flower braces.

Grease Wood.—A shrub common on many hillsides is the Greasewood (Adenostoma fasciculatum), yet few people seem to know it. In May, many hillsides are white with the blossoms of this shrub. It flowers in large feathery panicles, reminding one of our cultivated Spiraea Japonica. This is one of the very best shrubs for dry gardening and should be grown extensively.

Wild Buckwheat.—A good companion for the preceding and found growing under similar conditions is the Wild Buckwheat (Eriogonum fasciculatum). When in flower it is a charming plant with its deep olive-green foliage and large heads of white flowers delicately shaded with pink.

Carpenteria.—One of the most beautiful of our native shrubs is Carpenteria californica, forming an attractive bush from five to eight and sometimes ten feet high, freely branching and of fairly rapid growth. The leaves are light green on the upper surface, smooth or sometimes with a few scattered teeth on the margin and grayish white beneath. The flowers are in clusters of five to seven and sometimes as many as twelve blossoms. They are large, pure white with yellow stamens and have the fragrance of the Mock Orange flowers. The seed germinates very easily, but the seedlings are apt to damp off and require great care when in the young state.

Yellow Tree Poppy.—A good companion for the preceding is the yellow tree poppy (Dendromecon rigidum). The bush grows from four to eight feet high, has graceful willow-like foliage and bright yellow flowers, two to three inches in diameter, in shape and color almost

exactly like the Hunnemannia—see page 178. It blooms nearly all the year round, but is at its best in early spring. This shrub is hard to propagate.

Flannel Bush.—The Fremontia californica grows from four to fifteen feet high and reaches its greatest perfection on the desert side of our mountains. It flowers in early summer and the bushes are simply a mass of golden yellow flowers two to three inches across. No more glorious sight can be imagined than a mass of these shrubs in full bloom.

Fuchsia-flowered Gooseberry.—This common shrub in our foothills (Ribes speciosum) is well worth cultivating in our gardens. It transplants easily and can be propagated by cuttings, grows four to eight feet high and is of spreading habit. The flowers are about an inch long, rich cardinal red, hanging in long sprays much like a fuchsia. It is nearly evergreen and the leaves turn to beautiful shades of red and brown in the early part of summer and then drop, but soon after the first rain in the fall the plants burst forth with a new covering of rich green foliage.

Flowering Currants.—Three other species of Ribes are all desirable. The yellow flowering currant (Ribes tenuiflorum) grows in dry sandy washes, forming a low spreading shrub with bright green leaves and covered early in spring with a perfect shower of small yellow flowers. The pink flowering currant (Ribes malvaceum) found in many of our foothills is of rather erect growth with brown stems, rather heavy attractive foliage and drooping racemes of pale pink flowers. Another species similar to the preceding, has longer racemes of flowers which are of a bright pink shade.

Woolly Blue Curls.—On many dry ridges in early summer may be found the woolly blue-curls (Trichostema lanatum). It is of shrubby form with small crowded leaves resembling the foliage of the common rosemary. The buds and flower stems are covered with a thick purple wool, the flowers themselves being of a deep rich shade of blue. This plant is always found in dry places and will not stand a wet situation.

Manzanita.—The Manzanita is one of the most beautiful of our wild shrubs. It flowers in the early part of winter and the clusters of fragrant, waxen bells, contrast well with the pale foliage and rich brown stems. There are many species, Arctostaphylos tomentosa being the commonest form in Southern California. A. manzanita, common throughout the state; A. glauca, and A. patula are some of the most desirable. The manzanita is hard to propagate, the seed being uncertain, and very slow in germinating. One grower has been quite successful in layering plants, out in the hills and afterwards digging up the rooted layers.

The Mountain Mahogany (Cercocarpus parvifolius) is a pretty shrub of rather spreading habit with small dark green leaves. The flowers are quite small and inconspicuous, but the long feathery plumes of its fruit are quite pretty. It is particularly valuable for planting in dry places.

False Mallow.—A pretty flowering shrub belonging to the Malva family and found in dry sandy washes is Malvastrum fasciculatum. The flowers are closely set on long wand-like branches, are of delicate texture, pale pink and fragrant. The anthers are golden brown and with the pink petals contrast well against the grayish hoary foliage. Another desirable species has larger flowers of a rose purple shade.

California Flowering Ash (Fraxinus dipetala) is a deciduous shrub growing five to fifteen feet high with light green foliage and white flowers.

Wild Honeysuckle (Lonicera subspicata) is a climbing shrub particularly valuable on account of its great wealth of shiny green foliage. The common California honeysuckle is Lonicera hispida var. californica. This is the species which gives the beautiful red berries sometimes used in Christmas decorations.

As Mr. Payne's observations, as above outlined (with some additions of our own) were chiefly made in the southern part of the state, the resident in central or northern California might find his local native shrubbery somewhat different and probably greater in extent and variety, for the parts of the state with greatest rainfall are naturally richest in native flora. But such flora will be found to include most of those which Mr. Payne has emphasized as desirable, though other shrubs may take the place of some which he mentions as found in the interior, so-called "desert area," of southern California—which is not a desert but very fertile usually, as soon as its lack of moisture is supplied by irrigation.

Matilija Poppy.—This plant, which is sometimes called California tree poppy (Romneya coulteri) is often regarded as the greatest wild flower of California, and it has figured honorably in the hands of our local poets and painters. Culturally and descriptively, Mr. Leonard Coates of Morganhill says of it: "Strictly speaking, it is a semi-herbaceous shrub, growing wild on the hillsides and in the canyons of Ventura County and down into Mexico. The flowers average six inches in diameter, and sometimes measure seven to eight inches across. The petals are pure white and of a crinkled, crape-like nature. The numerous stamens form a glorious golden tassel in the center, the flower exhaling a delicate fragrance which has been likened to that of a ripe orange. The plant, under suitable conditions will, in a very few years, reach a diameter of ten to twenty feet, and half the height. They transplant with great difficulty, unless they have been shifted

several times and have become well established in the pot, after which it is a simple matter to turn them out wherever it may be desired they shall become permanent—with this precaution, however, that the roots must not be disturbed, and also that there must be perfect drainage and but little water given in the summer time. If allowed plenty of room and the ground is kept cultivated, no water is needed other than the winter rainfall. Germination of the seed is extremely slow, so much so that almost infinite patience is required."

The plant sends out numerous horizontals stems which rise through the soil at some distance, and become separately rooted some time after appearance. When such a new plant is well rooted it can be successfully transplanted by taking up in the autumn and cutting away the top growth. Transplanting at other times is very uncertain of success.

SUGGESTIONS OF EXOTIC SHRUBS.

The possibilities for foreign shrubs in California has already been indicated by the remark that nearly everything except plants of strictly tropical requirements may be expected to thrive somewhere in California. One must expect exceptions to occur in his local experience because the state is exceedingly varied in local conditions and yet it is reasonable to try whatever appeals to you as very desirable, wherever, away from the tropics, you may see it. And there is nowhere, known to us, a compilation of the names of the multitude of exotic shrubs which are now giving their growers pleasure in this state. All that the writer can do is to name and briefly characterize such as have come under his observation, and this would indicate that they are more or less common and therefore have shown some degree of acceptance of California conditions:

Almond.—The flowering almond, in pink, white and red, breaks into bloom from January to March in different situations and is easily grown and beautiful.

Azaleas and Rhodendrons.—There are grand wild azaleas in our mountains which the early summer tourist thoroughly enjoys, and some have successfully installed them in gardens, but those chiefly found in cultivation are the exotics which figure in the world's trade. The amateur who expects satisfaction with these plants must study their requirements, as indicated in other publications, and match his conditions thereto as well as he can, and begin with thrifty plants from the nurseries. They should be planted in well-drained peat mixed with sand, or leaf-mold and sand. They will grow well out of doors in deeply shaded places, as on the north side of the house where they may get the morning and evening sun, or under large trees. They blossom out of doors from April through July, according to variety. Usually

they are grown in lath-houses which afford a slight protection from both heat and cold. Near the coast they may with safety remain out of doors all winter in ordinary seasons, but farther inland, where frosts at night are sharper, they should be transplanted to the greenhouse in October; and if early blooming is desired, they may be forced by artificial heat. They may be propagated late in the fall and in early winter by cuttings placed in sand. They will root in six weeks with bottom heat. Without it they may require three months. Pruning, if needed to preserve form, should be done after the flowering season is well over. July is a good month, as this gives the plants time to make new wood and set their buds.

Bamboo and Cane.—Bamboos will be put with shrubs because they make woody stems and the species chiefly found in California gardens come within the stature-limits of shrubs, though species have been introduced which reach the height of trees. Truly, however, the plants are all grasses and not arborescent at all. In garden work they are very beautiful for their feathery foliage and grace of growth, and they make fine screens or low wind-breaks. They will accept ordinary garden soil and moisture, though they seem most at home along a ditch bank or on a pond-side. Some species make running-roots and are therefore less desirable for fixed places than those which grow in clumps. The bamboos form seed only at remote periods, which is desirable, because, as is the nature of many grasses, they die as soon as they form seed, and all the other plants of the same generation, made by dividing roots or taking offsets, will die also, no matter where they may be. The only way to get a new plant is to take one from another generation, and this probably can be had from large propagators who may have started plants from the seed at intervals. Species of all heights, from dwarf to a stature of 50 feet and great variety of foliage, can be had from the nurseries. All the bamboos which one will thus obtain are hardy and will retain foliage through ordinary valley frosts.

The soft-wooded reed, or false bamboo (arundo donax) is also useful for summer growth on large places. It has not the beauty of the bamboo, but for quick growth for a screen or wind-break to the windward of summer-blooming plants, it often serves a good purpose.

True tropical sugar cane makes a good summer growth in places where heat runs high and moisture is ample, and holds life in the root through freezing weather.

Brooms.—All the "brooms" are found abundantly in California gardens growing to the upper limits for shrubs and full of beauty and perfume. The most common are the Scotch and the Spanish, of which we prefer the latter for fullness and length of bloom. It has two set bloom periods, spring and autumn, but is apt to break out between and to be almost continuous. It can be grown either in bush or tree form,

but in the latter case needs a good stake against wind storms if it is grown fast with high culture. The Scotch makes a relatively larger show of foliage and stronger, upright growth, while the Spanish seems to throw most of its force into flowers.

Camellias.—The Camellia japonica is quite hardy in California and is a free winter bloomer, both on the coast and in the interior valleys. It is very easily grown and requires no special treatment, except that it must be watered moderately during the dry season, and it should be placed so that it will not have the full force of the summer sun. During cold storms in January the open flowers are apt to be discolored by the rain and the opening buds are sometimes injured by long rains and temperature a little too low to force their opening; but the plant is usually such a prolific bloomer that one is likely to get all the perfect ones he has any use for. The Camellia does not awaken very deep enthusiasm probably because of its wax-like, set rosette form and the absence of fragrance; it seems stiff and cold, though its colors are varied and rich. Camellias have reached greatest popularity in Sacramento, where one can see over fifty kinds in full bloom in February in the gardens, and there are several specimens over fifteen feet high and carrying over a thousand flowers. The Camellia is held to be less satisfactory in southern California than in the central part of the state. Camellias will vary a great deal from the seed and seldom reproduce the flowers of the parent plant. Usually small cuttings can be used to good advantage; take wood of the last summer's growth, remove two or three of the lower leaves, but leave the upper ones and plant in a box of sand as described in the chapters on propagation. These cuttings should have constant moisture and a fair amount of heat, but the soil should not be too wet, nor should it have direct sunshine.

The tea plant is a camellia of another species and has been successfully grown in the state ever since the pioneers of 1850 made some tea near Coloma in El Dorado County. Since then the plant has been grown as an ornamental in different parts of the state, and it has been demonstrated to succeed both in coast and interior situations. The requirements for a thrifty plant are good soil and moisture enough for a free growth. The plant is quite hardy. The insuperable objection to growth of tea in California is the cost of labor. Probably labor in California would cost five to ten times as much as in eastern Asia.

Cassias.—Cassia artimesioides is a winter and spring flowering variety, rather dwarf and decidedly one of the prettiest of the cassias. Its gray-green cut-leaved foliage is very attractive.

Cantua.—This low shrub with its small leaves (Cantau buxifolia) is called "magic tree"—perhaps from the bursting forth of long, tubular flowers from its scant twig growth, which is indeed surprising. It

PLATE 11: "THE CANARY ISLAND DATE IS OUR MOST SPLENDID HARDY PALM"—PAGE 240.

grows well in the open air along the coast from San Francisco southward.

Cherry.—The Japanese flowering cherries are being more freely used for their early spring bloom preceding foliage; large flowers of delicate shades.

Coprosma.—This is a popular low shrub in most parts of California because of its good behavior in the open air; its round, green and glossy leaves and its showy yellow fruits. It is sometimes trained up to support with good effect.

Coral Tree.—This tall shrub, remarkable for its handsome red flowers, a summer and autumn bloomer, is Erythrina Christi Galli, or coral tree. It is deciduous and rests three months during the winter in most places. The flowers are very large, pea-shaped, brilliant red shaded with maroon. They grow in spikes not infrequently measuring two feet in length in large specimens. When in full bloom this splendid tree is a most striking object. It is propagated from seed or well-grown cuttings. A seven-year-old plant from seed, in Ventura County, has reached 18 inches in circumference, 12 feet in height, with a spread of 20 feet. It should be trimmed back every year, thoroughly cultivated and the soil enriched, to force out new shoots, which run quickly to bloom-spikes.

Corchorus or Kerria.—This Japanese shrub which shoots from the earth abundantly, slim stems with crimped leaves and thickly set with bright yellow rosettes, is very beautiful. Its flowers appear early in the spring and are repeated through the growing season. The plant makes a good low clump if it has space for enlargement.

Cotoneaster.—Several species of small-leaved, low-growing shrubs are becoming popular because of the rich autumn effects of their abundant, bright red fruits, both for garden beauty and for decoration. They are easily grown and very satisfactory.

Crab-Apple.—Not only are the crab-apples grown for fruit exceedingly showy and beautiful in their bloom, but special varieties are propagated mainly for bloom and called "flowering crabs." They produce fine effects in spring bloom and carry good summer foliage.

Crataegus.—The species of the hawthorne family (called crenulata and pyracantha according to the taste of the botanist) and popularly known as the ""fire thorn," is a grand sight with its red thorns and autumn load of orange-red fruits. It is a free, thrifty grower and a joy to the garden. The cotoneasters, cratæguses and pyracanthas are closely inter-related.

Daphne.—This glossy-leaved low shrub, with its highly-perfumed, waxy flowers is delightful to have if one can grow it well. We have seen excellent specimens in various coast situations. They seem to need well drained soil and partial shade.

Diosma.—This plant, with its miniature coniferous, fragrant foliage and white starry bloom abundant in it, has a modest beauty either as a single plant or in low hedge form. It is very easily grown and is contented with ordinary garden conditions.

Deutzia.—Deutzias are very graceful with their slim branches thickly set with white or blush blossoms. The beauty of the plant depends largely upon cutting back after blooming to force out new growth of flowering shoots. The plants are easily grown from seed or cuttings, both hard and soft, as described in Chapter VIII. Deutzias do well with ordinary garden soil and treatment.

Geraniums.—These plants in their great variety of foliage and bloom-colors are too well known to warrant discussion, and yet so important in the joy of the garden that to omit them would be ungrateful discrimination. They all come readily from cuttings and they sow themselves also—myriads of new plants beneath and around old ones, during the rainy season. And though so common and so easily multiplied, the geraniums and their aristocracy, the pelargoniums, are well worthy the amateur's more careful attention. Nurserymen offer new varieties of great desirability, and the amateur who undertakes to improve his home collection by securing larger blooms, choicer colors and better foliage, will derive much satisfaction therefrom.

Heliotrope.—Heliotrope is at home in the open air in all places where frosts are light and can be carried through several degrees of frost by training flat against a house-wall as shown in Plate 10. Handled in this way it gives almost continuous bloom, enjoying full summer sun and being protected from many frosts which might otherwise blacken its outer growth. This training also makes it easy to remove excess shoots and avoiding smothering, which turns the interior of a large bush into a mass of dead brush. In bush form it should be often cut back for a new start. New plants are easily made by layering the shoots which rest upon the ground.

Holly.—The English holly, usually counted a shrub, makes a pyramidal tree very readily in California, though it will endure cutting back to hedge form, if one choose, and its use for Christmas decorations makes that more desirable. It can be easily propagated by planting the berries in seed boxes, as described on page 60, or from cuttings either in the open ground or in boxes under frames. The English holly is dioecious, and to secure the desirable fruit it is necessary to have staminate and pistillate plants associated, most of the trees pistillate, as one staminate tree will fertilize a large number of pistillate.

Hydrangeas.—These shrubs attain wonderful growth in the open air in most coast and valley situations if given more or less shade,

according to the fervency of the local sunshine. In coast situations, both north and south, they may grow to a height of six feet or more and a greater spread of branches, while single blooms in late autumn and winter may be a foot in diameter. They do well in openings among trees if given proper amount of cultivation and moisture. The plants are easily grown from branch-cuttings whenever the soil is reasonably moist and warm.

Jasmines.—"Cape jasmine," which is not a jasmine but a gardenia, does not altogether enjoy California dry air, though some satisfactory specimens can be found. It requires moist and warm air during the growing and blooming season, though quite severe cold will not injure the root.

Jasminum officinale, our common white jasmine, is very satisfactory with its clean compound leaves and flowers in terminal, leafy clusters—each a little nosegay by itself. It endures heat and drouth and does not resent neglect, although care and especially close autumn pruning or shearing to induce many flower stems, keeps the plant within bounds and floriferous. It does well against a south wall, but will accept what it can get and trained as a vine will cover large space. It grows readily from cuttings. Another white jasmine is grandiflorum, of light and spare foliage and straggling growth, needing support; but the flowers are always sweet. They thrive in rich, deep soil, in a sheltered location, and need very little pruning.

The yellow jasmine is of a more shrubby growth and makes a fine plant for a lawn. It is a rank grower and will in time reach a great height, though it must be pruned severely at times. It is an evergreen and always in bloom in warm-winter places.

Jerusalem Cherry.—This plant is Solanum pseudocapsicum, the specific name derived from resemblance of the fruit to a small red pepper. It is a very handsome ornamental shrub when filled with its bright red fruit, contrasting with the deep green foliage. Why it is called Jerusalem cherry is not known, for it is not a cherry and did not come from Jerusalem. The plant is a native of Madeira and was taken thence to England several hundred years ago. It is often sold in pots for holiday decorations, but one can have it in the open ground all during the frost-free season and it grows easily from seed.

Laburnum.—This is a most beautiful tall shrub or small tree with handsome roundish leaves and long streamers of pea-like golden flowers which have been aptly named the plant "golden chains." It blooms toward the end of the rainy season the flowers being followed by rather conspicuous dark-colored seed pods which may be clipped off to advantage of the appearance of the plant—unless one wishes to get the seed.

Lantanas.—These showy plants are very satisfactory as self-sustaining shrub-masses or as low climbers to be trained against walls, fences, etc. They have a wide range of brilliant colors and changing effects as the flowers age, which are interesting. They will endure only light frosts without protection.

Laurestinus.—A handsome dark green, medium-height shrub with abundant fall and winter white bloom and capable of being grown singly or in a hedge. It is frequently used in cemetery planting, and is on the whole rather somber.

Lavender.—The shrubby lavender, grown in England as a commercial crop, takes kindly to California conditions, even enjoying full sunshine on gravelly soil, but better treatment agrees with it and ordinary garden conditions give good results in "lavender sticks" of great length. It is easily propagated from cuttings of one season's growth, cut with a small piece of the older wood attached, and planted in spring or fall. These are set three to four inches apart in rather moist soil and shaded until they root. Division of the plant is also practiced.

Lemon Verbena.—The deliciously scented foliage of this small tree-like shrub makes it always desirable if well grown, though it becomes too scant-leaved and scrawny if not well treated. It needs frequent cutting back after flowering to force out new leafy growth, and although it will endure much drouth its appearance is much less satisfactory. The bloom is negligible; the scented leaves are the chief attraction of the plant.

Lilacs.—Probably all the lilac group of the syringas have been brought to California. We have grown a large bunch of them and have found the common white and purple varieties more satisfactory than the others. These make very free growth, rising to the highest limits for shrubs and give grand foliage and bloom in places where the summer's heat does not run too high and where the spring warmth comes early, for the plants are very restless under California winter conditions and sometimes begin work too soon to get a good bloom-spread. The plants should be kept from too early dormancy by sufficient summer irrigation, so that they may grow longer in the autumn and be inclined to rest longer in the rainy season. They should be pruned soon after blooming to induce growth of new blooming wood and many thin, ineffective shoots may be thinned out or shortened for better starts.

Malva.—The tree malva (Lavatera) is very common in all parts of the state around old ranch houses, and growing frequently on vacant lots in our cities. It is very drouth-resistant and has been frequently mentioned as desirable for forage purposes. If it were not so common it would be counted very handsome. Its chief value at the

present time seems to be as a quickly growing shade and forage plant in chicken yards, where it serves a most excellent purpose, or for making a screen in front of unsightly objects. It comes from the seed to a height of six feet or more and full bloom within a year.

Oleander.—Both the pink and while oleanders are very conspicuous in the warmer valleys of California, where they are very popular for their gorgeous floral effects. They enjoy the fullest heat and will get along with moderate moisture. In the low summer temperature of some points near the coast they do not open their flowers well, and are undesirable.

Peach.—The double white and double pink flowering peaches are beautiful garden ornaments and give much desirable branch-cutting for house decoration. The pink is the stronger grower.

Peonies.—The herbaceous peonies are but little grown in California in spite of the beautiful colors and shades which have been developed in them. We have seen as fine blooms here and there in California as we ever saw anywhere, but thus far they have not achieved popularity. The Japanese arborescent peonies do well in most parts of the coast region except that they are disposed to bloom during the rainy season and are sometimes, in this part of the state, destroyed of beauty by drenching winter rains. Sometimes, too, the plants become unthrifty, which is probably due to summer drying, to which they are not accustomed. Evidently the needs and behavior of the tree peonies need to be carefully studied by all who undertake to grow collections of them.

Poinsettias.—The approach of winter, especially in southern California, is made gorgeous by the abundant bloom of the poinsettias. The plant thrives in the open air near the coast. From Santa Barbara southward it is not uncommon to see the plant ten feet in height, with a spread of fifteen feet and a stem four inches or more in diameter. The branches of these large plants are numerous and each one is terminated with bracts of the most intense and brilliant scarlet, the largest of which measure from fifteen to eighteen inches across. They bloom for three months and are invaluable in gardens and parks, having a brilliant effect and bloom most profusely when other flowers are scarce. After losing its foliage the plant should be cut back to within a few eyes of the old wood. It grows readily from cuttings, which can be started in the open ground. On large grounds it is very effective planted in groups.

Quince.—The Japanese flowering quince, in different shades of pink, is the first of the deciduous growths to appear in midwinter. The shrub clothes its branches with abundant large bloom and flashes out like a flame while the garden is apt to be a little somber. The

long bloom-bearing shoots are very effective in large vases. The plant grows itself under ordinary conditions.

Snowball.—This popular eastern shrub is not so abundantly seen in this state, but it does well none the less and is glad to repay old affection in the new California dooryard.

Spiræas.—This group, including the old "bridal wreath," has a long summer-blooming season in this state and thrives with only ordinary care.

Streptosolon.—This plant, which has foliage like the heliotrope and masses of orange-yellow blossoms, is very striking and satisfactory and is becoming more popular. It may be grown as a shrub-mass in a sunny exposure, and it also does beautifully on the sunny side of a wall or fence to which it may be trained as a low climber. It is almost a continuous bloomer, except during a short rest in January.

Syringa.—The "sweet syringa" grows to the limits of shrub sizes in good soil and blooms profusely. The writer has enjoyed the effect of training against a high fence a large bush which was increasing beyond available limits.

Tamarix.—The feathery foliage of the tamarix is always a striking object and its plumes of pink flowers are beautiful. It accepts even rather hard situations and is grateful.

Weigelia.—The tubular pink flowers of the weigelia are quite common in California and the plant is a good grower and hardy, requiring only ordinary conditions to give satisfaction almost everywhere.

CHAPTER XXIII.

GARDEN PALMS FOR CALIFORNIA.

Palms should receive wider and more discriminating attention from Californians. It is true that we are planting a good many, but we are not using them in a way befitting their great beauty and their great variety in size and form. We are fortunate in possessing a climate in which very many palms are perfectly hardy and in that respect California differs from other regions in our own latitude in the United States. We are able, then, to give our landscape striking features which we can ourselves continually enjoy and which will appeal strongly to the visitors who come to us from the more northerly countries. California should become, in all save the higher altitudes, distinguishable as a land of palms.

But for this reason, amateurs should not rush into planting palms without forethought and calculation. It requires ample resources of land and money to indulge in palm collections, for, aside from a few which are largely used, the plants require considerable outlay. Besides, one is apt to place the small plants so near together that they grow into crowding each other and afford no perspective views of their beautiful forms and attitudes. Again, indulgence in palm collections should never be entered upon without knowledge of the local temperature records and a study of the limits of different palm species. A few of them will endure any temperature which has visited California valleys, even to fifteen degrees below freezing perhaps, others resent frost like a lemon tree. Therefore one should have a reasonable enthusiasm over palm planting.

What California Can Do with Palms.—We measure our palm possibilities by what has already been accomplished in places which have been properly selected. On page 9 is a statement by Dr. Franceschi which credits the Santa Barbara region with successfully growing in the open air not less than one hundred and fifty species of palms. Mr. Thomas Compton gives further details concerning the growing of palms in the Montecito Valley:

"The palm is the grandest and most striking feature of the whole vegetable kingdom. Palms range in height from one or two feet to one hundred feet and can be used for the ornamentation of avenues, grouping for landscape effects, or as single specimens. In the Phœnix palms we have between twenty and thirty different species and almost as many shades of foliage. About twenty-five species of Cocos have been tried and successfully grown. They range in height from six to ten feet. Some are very striking objects; all are graceful and should be more extensively used than at present. The australis type of the

Cocos is the most justly admired palm in every garden where they have been used. Kentias have a very graceful drooping habit. Five of the varieties have been grown with success. The Sabals are rather slow in forming a trunk; some of the species attain a height of one hundred feet and are stately, massive and grand. Fifteen varieties are known to be hardy in Montecito. Thrinax is a drooping, graceful, fan-leaved variety. Six of the species are known to succeed here. There are over one hundred species of palms that are known to flourish luxuriantly in the Santa Barbara region."

There are mesas bordering other California valleys where quite as much can be done, but they must be sought and verified in advance of investment for this particular purpose.

Kinds of Palms.—Limitations of space will not allow us to present even such limited knowledge as we have about the different kinds of palms which are generally hardy and available for common garden planting. There are a dozen or twenty of that class and the nurserymen describe them in their catalogues and can furnish them at reasonable prices. Beyond that one has to go to the specialists in palms. The safe and sure ones can also be seen in the parks and older gardens in the different regions of California. The intending planter should make such local studies for himself.

The palms which have been used in largest quantities are the California fan palm, the Japanese fan palm, the fruiting date palm and the Canary Island date palm. All these are tall growing and available for street or avenue planting, if one likes palms at all for that purpose.

Most notable is the Canary Island date palm, of which a portrait is given on plate 11. It is our most splendid hardy palm and the planting of it has been so widespread during the last few years that it bids fair to displace the native fan palm as the most prevalent palm in the state. It is strikingly superior thereto in grace and beauty; is quite as hardy and can be as readily grown from the seed. It thus becomes available for the widest planting and none need miss its possession on the ground of cost. It should be planted widely over our valleys and foothills, for its graceful head of foliage and its rhythmically swaying leaves are fitting and beautiful in almost all situations, but one must remember to give it room enough. The plant shown in the engraving has a spread of foliage 26½ feet in diameter and is 33 feet in height. Its beauty attracts the attention of passers-by and rewards them for the study they make of its symmetry and beautiful arrangement of leaves. It is a staminate plant and different in robustness and density of crown, from the pistillate, the latter being, so far as we have observed it, a more open and smaller plant—more airy and light and perhaps to some tastes more graceful. For ornamental purposes the Canary Island plant is greatly superior to the fruit-bearing date, which has a more bristling and bustling aspect, as a plant should which is

charged with such important business. The Canary palm is simply beautiful, and acts as though it were aware of the fact—which is not a fault in a plant-beauty.

Planting Palms.—Young palms can be transplanted without taking earth with the roots if they are not to be subject to long exposure, but the percentage of success will depend upon the care taken. Mr. H. E. Butler of Penryn has succeeded notably in this way: Dig a hole considerably larger than the base of the palm. Break up the lumps and mix the dirt with manure, or complete fertilizer and old leaves, fine grass, etc., for humus. Fill the hole with the mixture, pack it down, then dig out enopgh dirt in such a way as to leave a cone, in the center of the hole, with its point level with the ground, and flattened for the palm to rest on. Then spread the roots evenly over the sides of the cone and pack the rich fine earth over them. The packing is important, to prevent the plant from settling with the dirt if unpacked. The palm cannot thrive if any part except its roots is underground. Failure follows setting the plants too deep. Even if such plants live they fail to grow well.

Transplanting Large Palms.—Large palms can be moved successfully with few roots if abundant watering is done to keep the large trunk from drying out; therefore water should be applied freely to the trunk. Palms are very easy to move because they have rope-like roots which hold a ball of earth together. It is not likely to break and fall apart as in the case of moving other trees. Trench around the plant with a sharp spade so that the inside of the trench shall be a foot or more (according to size of plant) from the base of the palm. Go down a foot or two feet (according to size of plant, again) and then cut under with the spade, until the plant stands in a loose ball of earth. Lift out, with tackle if necessary; settle the earth in the new place with water and keep moist. Remove a good part of the leaves before moving.

Growing Palms from Seed.—Canary date palms and California fan palms grow very readily from the seed; the former particularly so, and in fact often volunteers if the ground under the tree happens to be kept moist. No treatment should be necessary except to keep continuously moist, but not wet. To put in ordinary soil in full sunshine and water once in a while gives an alternation of dry and wet which does not give good results. Try the seed in a place of half-shade, cover only a little with light, sandy loam and cover above with a thin litter of leaves and sprinkle frequently, but not too freely, and you ought to get palm seedlings freely. Better methods for handling palm seed are those described in Chapter VII for seeds generally.

Trimming-up Palms.—There can be no question that palms are made lanky and unthrifty by too free trimming up of the old leaves

for the sake of neatness. The way natural to a palm is to maintain a green crown and allow the dying leaves to decline and finally form a thick clothing for the stem, retaining their places for many years. The view of an old palm should present a clean, cylindrical shaft below; above that the cover or thatch of dead leaves and above that the crest of verdure. Most people, however, think that a palm does not look neat with its shaft littered up that way, and so they cut off all the old leaves and then cut off the living ones as soon as they begin to show discoloration of age. If you like that sort of a palm you can go to plucking the old plumes whenever you feel like it. One time for doing so is as bad as another.

If one dislikes the stubs he makes by trimming up he may conceal them and perhaps compensate for the protection against heat and drying which the natural leaf-cover provides, by growing light vines on the palm trunk. Heavy vines should not be used. They are too aggressive. Muehlenbeckia has been used with rather good effect, but Kenilworth ivy is to us more graceful and appropriate. Of course many others are suitable for the purpose. It is natural enough for tropical palm trunks to be vine-clad.

CHAPTER XXIV.

TREES FOR SHADE AND ORNAMENT.

Obviously we can take but a glance at the trees—just as every garden-visitor does after his attention has been concentrated for a long time upon the flowers which his host has been commending to his enjoyment. It will do to remember that California has not only "big trees," but many trees which are distinctly her own by birth—"an unusually large number of them," says Dr. Jepson, and the reader who wishes to know their unique characters and their wonderful history, will of course study Dr. Jepson's books mentioned in the footnote upon page 8. California has also many trees which are hers by adoption—hundreds of them, whose introduction has been compelled by all motives of beauty-loving and wealth-winning which have actuated our cosmopolitan population. We shall assume the duty of mentioning only a few which have achieved wide popularity, thus demonstrating suitability for choice by the amateur who wishes to be assured first of all that the few he plants shall be thrifty and satisfactory. Although occasional reference may be made to the desirability of a tree for highway and avenue planting, this suitability will not be systematically pursued. The chief purpose will be to indicate trees from which selection may be made for shade or ornament in connection with door-yard planting or for the shaded areas which may be provided in the environment thereof.

Acacias.—These evergreen flowering trees, chiefly from Australia, constitute an important feature of our exotic silva. Scores of species have been introduced and if one desires to pursue them botanically and descriptively it is now possible through the contribution by Miss Katherine D. Jones of the University of California to the 1914 edition of the Standard Cyclopaedia of Horticulture. The following are very widely grown:

Acacia decurrens; variety, normalis.—The well-known "black wattle" tree of Australia, a medium-sized tree of rapid growth, with beautiful fern-like foliage and brilliant yellow blossoms.

Acacia melanoxylon (blackwood acacia).—An upright, symmetrical, pyramidal tree, of rapid growth, with dense foliage. Very neat and trim in appearance, making an excellent sidewalk tree.

Acacia pycnantha (golden wattle).—A medium-sized or small tree, well branched, with heavy foliage, and dense clusters of beautiful yellow flowers, borne very profusely in spring time. Bark also very valuable for tanning purposes. Tree of rapid growth, but often suffers from breakage by wind. Very ornamental when in bloom.

Araucaria.—These well-known greenhouse plants in wintry climates are tall trees in the open air in California. The Norfolk Island pine (excelsa) is seen everywhere in the coast and interior valleys and foothills, lifting its stately form—generally with less than half enough space to grow in. The Bidwillii or "bunga-bunga" is a more satisfactory tree under trying conditions of heat and drouth.

Ash.—This tree is found native in parts of Texas, Arizona, Nevada and northern Mexico, varying considerably in size and appearance, but it is everywhere a drought-resisting ash of great value and worth extensive planting, for it has demonstrated its success in the most trying places in California. It is not, however, very rapid in growth.

Birch.—These well-known white bark, hardy trees are beautiful in clumps or as single trees. The cut-leaved, creeping birch is a most graceful and desirable tree and quite rapid in growth under ordinary garden conditions.

Bottle Tree (Sterculia diversifolia).—This is the "bottle tree" of Victoria, a stout, glabrous tree from 20 to 60 feet in height and having a peculiar bottle-shaped trunk. It is a very striking tree in appearance and has shown its adaptation to the coast region at least, especially in southern California. Mr. Earnest Braunton of Los Angeles says of it: "It is one of the cleanest of trees, of a bright, pleasing shade of green, the trunk is straight and mast-like, the branches are not far reaching and therefore not liable to injury by wind, and needs little if any pruning; it is a fast grower when well supplied with water, yet noted for its drought-resisting qualities. Its general outline is well-nigh perfect, its carriage graceful; it does not grow so thick as to harbor dead leaves and rubbish, yet enough to cast all needed shade; seldom does one make abnormal growth, and it will not injure the sidewalk by upheaval."

Camphor.—The camphor tree is a handsome, broad-leaved evergreen, attaining large size and noticeable by the characteristic light green of its foliage. It endures in California a temperature as low as 20° Fahr., and is probably about as hardy as the olive. Thrifty trees can be found in California valleys as far north as Shasta County. It succeeds on a great variety of soils but makes its best growth on rich, retentive soil. The trees can be readily grown from seed, which should be planted in sandy loam in January or February, according to the time when the soil becomes warm, covered about one-half inch and kept moist but not wet. Growth in seed-boxes protected from cold winds and with partial shade until the plants are in full leaf is to be commended. From the boxes transplant into nursery rows early in the fall, retaining the earth about the roots as much as possible and using water if the soil is dry. The trees endure transplanting even

when of considerable size by the treatment usually accorded olive or orange trees.

Carob.—This handsome, round-headed tree will produce excellent effects in dry places, among rocks, etc., although it relishes better places and easier conditions.

Catalpa.—Catalpas are very satisfactory in all California localities; full, hardy and enduring high heat and drouth.

Cedar.—The Himalayan cedar (Cedrus deodara) is perhaps the most glorious of the introduced conifers of California, and it has a very wide range of suitability. Splendid specimens are seen in parks and gardens in all our valleys and foothills north and south. Experiments in reforestation carried on by the government on the mountains north of Santa Barbara, have demonstrated that the deodara thrives better than any other species, even exceeding the conifers native to the locality. The foliage is gray rather than green, with lacelike effect and somewhat drooping attitude. It is not a large tree and still attains good stature and breadth. It is beautiful and dependable.

The Cedar of Lebanon is also quite at home in California and is a delight to those who prize historical associations.

Chestnut.—The Italian or Spanish chestnut is a tree of fairly rapid growth, cleanly built trunk and branches and handsome foliage. Single specimens are very symmetrical and impressive and give a dense shade.

Cypress.—Our most widely grown cypress is that from Monterey. It is native to a rocky area about two hundred yards wide and a few miles in length along the California coast south of the Bay of Monterey, where it grows about fifty feet high and forms in age a broad flat-topped crown resembling a cedar of Lebanon. With cultivation it becomes a symmetrical, rapid-growing evergreen, or it may be kept clipped to hedge form. It is largely grown as a windbreak.

The Italian cypress does well, where tall narrow plumes are desired —chiefly by the architect.

Elms.—Elms demonstrate their delight in California and though we have none so old and famous as the historic elms of the east, they are on their way. Wherever the American white elm (Ulmus Americana) has room to spread its branches in all its glory of foliage, it is a model tree and fine specimens are found with only a few years' growth on them. It is somewhat subject to wind-breakage of branches and is safer in the lee of other trees.

The cork bark elm is a smaller and more compact tree, with peculiar cork-like excrescences on the stem and limbs. It is very widely successful and by some recommended more highly than any other variety.

The European elm is often commended as the most desirable of all the elms as a street tree in California. It has a stout, round trunk,

symmetrical crown and comes into full foliage in the middle of February, two months earlier than the cork elm.

Eucalyptus.—The eucalyptus species of which scores have been introduced from Australia do much to make the California landscape surprising to Eastern and European eyes. Besides the species largely planted for fuel, timber and shade—such as the blue gum, red gum, grey gum, etc., as offered in all California nursery catalogues, there are other species which are superior for floral effects and therefore nearer to our present purposes. A few will be cited:

Eucalyptus polyanthema.—Fine tree of full habit, well-branched, with heavy foliage, leaves ovate to rounded in shape, gray-green to soft blue-gray in color. Flowers small, white, in close clusters on ends of branchlets, much resembling gigantic heads of mignonette. Bark roughish, brown, persistent; withstands considerable frost.

E. diversicolor.—The "Karri." Straight, well-branched, symmetrical tree. Leaves ovate-lanceolate, pointed, dark-green, glossy. Flowers white, in heavy clusters; April, May, June, and again in November. Bark smooth, grey-brown, persistent for some years. Profuse bloomer; useful for bees. Good shade tree; yields valuable timber. Growth rapid.

E. cornuta var. Lehmannii.—Displays tendency to divide into several stems at or near ground, making a spreading tree. Leaves small, oblong, thick in texture, dull-green. Flower buds very large; resembling close clusters of horns; flowers in large, globular heads of apple-green filaments; fruit in large, close, spiny clusters; all very remarkable. Blooms July, August, September. Growth (time and conditions as above)—height 24 feet, spread of branches 30 feet. Valuable as an ornamental and as a botanical curiosity.

E. citriodora.—Rather slender, straight-stemmed tree, with long, slender, drooping branchlets, and long, narrow, sickle-shaped, bright green leaves. Flowers creamy-white. Leaves exquisitely lemon-scented, retaining the perfume when dried; beautiful and very desirable ornamental.

E. robusta.—Handsome, symmetrically branching tree. Leaves large, ovate-lanceolate, pointed, dark green, glossy, leathery. Flowers large, white. Free bloomer, valuable for bees. Fine avenue tree.

E. calophylla.—Well-formed tree of regular, symmetrical outline, and rather pyramidal form. Leaves ovate to ovate-lanceolate, pointed, dark-green, glossy. Flowers large, white, in large clusters, very conspicuous; seed capsules large, urn-shaped, remarkable. Bark cinnamon colored, persistent. Fine ornamental and shade tree.

E. leucoxylon var. rosea.—Elegant, upright tree, with drooping branches, and light, glauceous blue foliage. Leaves medium-sized, lanceolate. Flowers pink, in loose clusters along the drooping

branchlets; February, March, April. Bark rough, fissured, reddish-brown, very resinous, persistent, contrasting well with the foliage. Growth (time and conditions as above)—height 37 feet, girth 39 inches. Wood of very superior quality. A tree of many attractions.

E. ficifolia.—The scarlet flowered gum, a gorgeous sight indeed when in bloom; moderate sized tree, foliage dark green, glossy; not a fast grower and not compact and symmetrical in habit, but a marvel with red bloom and large brown seed capsules. It bears its huge pinnacles of brilliant flowers after the second or third year, remaining a long time in bloom.

E. crebra—narrow-leaved, iron-bark; remarkably tall and slender; bark is thick, rough and persistent; foliage feathery, drooping; very ornamental.

Eucalyptus seedlings can be quite readily grown by soaking the seed a few hours in warm water and sowing in boxes in sandy loam soil. (See page 60.) The seed should be covered very lightly indeed and the soil kept continually moist, but not wet, and it should have a fair amount of heat, but not direct sunshine. The seedlings can be planted out when they attain a height of 8 or 10 inches.

Ficus.—This is a very quick-growing and ornamental genus of trees, including those known as rubber trees. They are useful where shade is desired; also, if the concealment of any undesirable objects is concerned. They are all hardy in most coast and valley situations and can be grown without irrigation, usually. Microphylla is one of the most vigorous growers.

Ginkgo.—The Ginkgo or maidenhair tree is the sacred tree of Japan and China, and some excellent specimens are found in California. It is of rather slow growth, but is interesting on account of its historical association and its foliage which resembles that of a maidenhair fern. In the autumn the leaves turn a beautiful clear golden color, lasting so for some weeks before falling.

Grevillea.—Among evergreens, Grevillea robusta, the Australian silky oak, is admirable for its quick and pyramidal growth, as well as for the elegance of its fernlike foliage, and the profusion of its orange-colored blossoms, was it not for the brittleness of its branches in locations much exposed to the wind. In a sheltered place it is a great beauty.

Locust.—The old-fashioned locust, which makes a dense shade and produces a wealth of large fragrant blossoms, will always claim consideration as a shade tree and is ever likely to be chosen for hot and dry situations where other trees may fail. Nothing seems to be too hard for it.

Lindens.—In Germany the tilia is known as linden; in England, lime-tree, and in the United States, bass-wood. The European species

has the larger leaves and is very satisfactory. Of the basswoods, Tilia Americana is most used, although T. heterophylla is more ornamental, having larger leaves, smoother, and with a silvery sheen underneath. The lindens do well even in our hottest valleys and are, of course, hardy enough for the mountains also.

Maples.—One of the best maples we have is the "big-leaved maple" (Acer macrophyllum), often called California maple or Oregon maple. This native maple grows along streams in the mountains and is a highly desirable shade or street tree in loamy or sandy soil which is not too dry. In cultivation it is remarkable for its rapid growth, clean habits, hardiness and resistance to wind-breakage. The hard maple, as well as most of the Eastern and European maples, do well in most parts of California, some of them showing pleasing autumn colors.

Magnolia.—The magnolia grandiflora does very well in some sheltered localities, but needs a good depth of soil, which is often hard to secure on high ground. It requires plenty of moisture in order to insure fine blossoms. In such conditions it is one of the most magnificent trees known, its large, strong scented flowers appearing all the year round in some places.

Pecan.—The pecan makes a good growth both on the coast and in the lower lands of the interior valley. It grows 40 or 50 feet high in the interior valleys, where it is admired as a roadside tree.

Pepper.—The beautiful and well-known pepper tree is still being planted largely in spite of blame placed upon it for harboring insects injurious to fruit trees; also for constantly dropping leaves, blossoms and berries, which are a source of annoyance if the trees are planted where they overhang lawn, building or walk. But for a long, shady lane, what can be more beautiful? Their drooping, swaying branches, their fern-like leaves, their bright red berries, and dainty flowers are hard to resist. The result is that if one excepts the blue gum, no tree has been more extensively planted in California than the pepper tree, and it will remain one of the most valuable introductions from abroad, as it thrives everywhere and under the most unfavorable circumstances.

Pines.—The several pines native to our mountains, may all be successfully grown where there is good depth of soil, and all exotic pines, so far as we know, are reasonably glad to get to California, but our best pine is that native at Monterey, pinus insignis, which makes a grand, tall and massive evergreen both in coast and interior valleys.

Poplars.—All the members of this large family seem to be at home in California. The cottonwoods are wild along streams even in so-called desert places. The Lombardy poplar lifts its high plumes along miles of valley farms and highways, where it serves as a tall wind-

PLATE 12: "THE WISTARIA WILL ENVELOP TALL HOUSES WITH A WEALTH OF BLOOM AND FOLIAGE"—PAGE 254.

break. The Carolina poplar is a splendid street tree, surpassing in its habit of growth or outline of crown the big-leaf maple. Its changing aspect is very interesting as it passes from naked limbs to jewelled tassels, which are succeeded by the handsome foliage. It is best propagated by cuttings, which should be all of one kind, and were better taken from the male tree to escape the immense quantities of downy seeds, which are an annoyance. The silver poplar is a round-headed tree with very striking foliage, the silvery under surface turned outwards under the play of the wind. It is an ornamental tree of old-time California gardens.

Sycamores.—Our native sycamore (platanus racemosus) is another very handsome tree which endures severe frost, as well as some alkali. While its deciduous habit would be objectionable for some purposes, it would make it very desirable where shade was wanted only in summer. Even when bare of leaves the tree is picturesque and beautiful. The European plane tree is also highly recommended for ornamental use. It is perhaps more sensitive to frost than our sycamore. Both varieties need soil of a good depth, and an abundance of moisture, but under proper conditions grow rapidly. In Los Angeles, trees which, at the time of planting, were at the butt about the size of a hoe handle, in four and one-half years the largest was eight inches in diameter.

Texas Umbrella.—This is a horticultural variety of the Pride of China, and much superior to it. It forms a compact and very dense crown composed of a multitude of erect and ascending branches foliaged with compound leaves. It is a prime favorite throughout the San Joaquin Valley and is being more and more planted in other valleys. Its use enables a good summer shade to be obtained in the warm interior valleys on the shortest possible notice. Its autumn foliage takes on yellow hues which splotch with color many a village street. It seeds very freely and to be sure that you do not get the inferior China tree, it is easy to grow your own seedlings. Take the seed from a tree of the right type which has no China tree within a quarter or half a mile. Gather the berries and mix them four parts fine sand, one part berries, and bury them where they will not be disturbed and where they will not become dry, nor too wet. If in danger of moles or gophers, wrap up in piece of wire netting. In the spring, when all danger of frost is passed, plant in rows 3 feet apart and 3 or 4 inches apart in the row. Never irrigate unless the plants seem to stop growing, and if water should be used make a V-shaped trench as close to the plant as possible and cover up with dry dirt as soon as absorbed by soil. One can grow trees this way 6 to 8 feet the first year from the seed.

Tulip Tree.—Liriodendron tulipifera is the great tulip tree of the Atlantic and Southern States. In many districts this is almost a swamp

tree, but it will grow in some parts of California exceedingly well. A tree near Niles, in Alameda County, about fifteen years old, stood about thirty feet high, with a noble sweep of branches. This tree grows slowly after the twentieth year and its ordinary height is hardly above sixty or seventy-five feet.

Walnut.—Both the eastern and native black walnuts make grand shade trees over a large and varied area in California, from the intense dry heat of the interior to the cool and moist conditions of the northern coast line. Some prefer the eastern black walnut because it is inclined to drop all its leaves at once instead of being so slow about going to sleep as the native species is—thus scattering litter for a long time and keeping the ground wet by partially excluding winter sunshine.

CHAPTER XXV.

CLIMBING PLANTS FOR CALIFORNIA GARDENS.

From what has been so freely asserted about the free-growing delight which all other classes of plants manifest in California the reader may be left to infer that climbing plants do well and that for many kinds of them, the luxuriance of their growth and the abundance and gorgeousness of their blossoms, as displayed from tree-tops and house-tops, if they are allowed to have their own way, California is remarkable. Native vines of which the botanists and wild-flower enthusiasts tell us (see page 8), clamber over the ocean-side cliffs, submerge the tall sycamores along the river-banks, and even spread their delicate foliage and flowers over large areas of the valley plains. The amateur who resolves to use only California native plants in his garden, will find no lack of wild vines to complete his purpose. And in the line of suitability for exotics, what has been said of all other plants is true for vines; you can grow successfully all the climbers which dwellers in temperate and semi-tropical zones enjoy, but you must stop short of the real tropics, as several people who have tried to grow vanilla in California have sadly demonstrated.

Ways of Growing Vines.—There is the same issue between the artist, poet and gardener in the growing of vines as of other plants. This is suggested, and some principles which the gardener must observe, are given in Chapter XI. It is the gardener's art to grow a vine so that it shall en-clothe a building, a pergola or a trellis, showing to best advantage its foliage and bloom. It is the artist's and poet's desire, generally, that the vine shall not be trained, but shall be permitted to embower whatever support it can gain possession of. The result is that the properly trained vine remains the permanent investiture of its support, disclosing its outline and decorating it with the beauty of leaf and flower; while the untrained vine becomes a shell of growth covering an internal mass of dead leaves and twigs and imprisoned litter, until an unusually high wind blows off the whole bower with its accumulation of old birds' nests, dusting cloths and other things lost from windows, and various articles thrown from time to time at too melodious cats. And in its fall the poetic and artistic rubbish will probably break to pieces many desirable shrubs and other plants.

Probably the owner will scrub off and repaint the house and declare that never again shall a vine grow upon it, but this is not the right answer. Vines should grow upon houses—in the California climates at least. They are innocent of the harm commonly charged upon them

and they have great beauty. But they should be regularly and systematically pruned and trained. After planting take the canes and fasten them flat with double-plointed tacks of large size, which are now available at all hardware stores, or stretch wires to which they may be securely tied. Direct these canes toward unoccupied spaces and thus make a perfect cover. When all the available space is covered, remove, as soon as you see them, all suckers which show a wild desire to embower the place. This not only disposes of their encroachments, but it throws more strength into the canes or branches which are in the right place, and it gives you better leaves and flowers on the shorter growths which come from such branches. Get a long, light ladder which one person can easily handle, and be always ready to give the vines needed attention. The best single time to prune vines is just after blooming. It is usually then that the riotous suckers are most likely to appear and cause your vine to go wrong.

A FEW GROUPS OF GARDEN VINES

It would require half a book of this size to present interesting facts about vines which are a joy in California gardens; the nurserymen's catalogues offer them by the score and usually they do not say too much in praise of them. In this connection only a few groups can be mentioned.

Summer-Growing Vines.—For summer screens for piazzas, etc., upon which winter sunshine is desired, many herbaceous annuals or other plants which die to the ground are available. Hops, either from seeds or roots are very fast and shady. The Australian pea-vine is particularly fine for covering low walls or fences and even porches. It will stand very hot places and furnish abundant bloom, and in frosty places will go to the ground like the hop. Morning glories and ipomœas are also very good. The gourds are very interesting. Cobæa scandens is rapid and has a tropical aspect. The "wild cucumber" or "manroot," though a weed in a watermelon field, is beautiful, with its free summer growth of light-green, ivy-like foliage and light-yellow blossoms, is a very good cover. Smilax from seed sown in February follows vertical strings, makes a light, beautiful summer screen and gives you good holiday decoration. And there are many others.

Bignonias.—At least half a dozen bignonias are available and are not sufficiently known. They are gorgeous in bloom, in colors from white, yellow, orange and red. Most of them are never seen in wintry climates except in greenhouses, while in California some of them rush for the roofs of tall houses unless they are systematically trained as they should be.

Bougainvilleas.—Two species are common in the central and lower coast regions and other places of similar temperatures—even enjoying

valley heat if well treated. They, too, are apt to be rank growers and need training.

Passion Vines.—Passifloras also succeed over large areas of the state. Perhaps the best for foliage and color is the scarlet passion vine (manicata) but it needs to be out of the frost. More hardy, and yet not out of reach of frost, is the pink passion vine (Tacsonia mollisima) which will range over fences, buildings and away, making rods of growth and thousands of great flowers, followed by large yellow, edible fruits, which both the chickens and the children enjoy, but it gets very shabby if not resolutely pruned and trained. And there are many other passion vines grown in thermal places.

Solanums.—Two potato-blossom vines are widely grown and their blooms in white and blue very beautiful—the latter (Wendlandii) can hardly be overpraised for a nearly frostless place.

Clematis.—The free growing white clematis (paniculata) and the deep purple (Jackmannii) are most widely grown and they have quite a different blooming season. They are good everywhere, while the improved more tender varieties need the attention of a specialist.

Honeysuckles.—Honeysuckles are for everybody and everywhere. The old sorts most popular at the east are far less satisfactory in California than the Japanese and Chinese varieties.

Jasmines.—Some of these species have been briefly discussed in Chapter XXII. They are good climbers also and they can be trained either way. Another, which is a near-jasmine, is Mandevillea suaveolens—is a rapid-growing deciduous vine blooming freely in the summer. The large clusters of pure white flowers are borne on long stems and are very beautiful. Another is the Malayan jasmine, Rhyncospermum jasminoides. The flowers are borne in pretty, graceful clusters. Its cultivation is easy, and where trained over a low trellis, is lovely.

Plumbago.—Both white and blue are good, low climbers—the latter more strikingly beautiful. It endures heat and drouth very well and blooms all summer.

Climbing Fig.—Ficus repens is interesting as a very close climbing vine which tries to preserve the form it covers and is not obtrusive. It is good for decorating a house wall or a porte-cochere.

Ampelopsis.—Perhaps no vines are more popular than the ampelopses. We enjoy the old Virginia creeper for its autumn effects chiefly, but the vine which is going everywhere on public and private buildings, stone fences and concrete retaining walls, etc., as the Japanese ampelopsis veitchii, which has been re-named "Boston ivy." It is widely planted in California, where it succeeds admirably and is much admired. It preserves the outline of the wall and thus heightens architectural effect. It needs little trimming except to remove trailers

which fail to make attachment. It presents an even surface of bright green, changing to dark green and to various shades of red as the autumn advances, and drops its leaves in winter that the sun may warm and dry the walls during the rainy season. It seems to endure the hottest sun of the coast region on brick or stone walls, but we have seen it burned on board walls and fences, which may limit its availability for frame buildings, and yet it is very commonly used upon them.

Akebia quinata.—This is a strikingly pretty vine for a rather low support over which it can clamber as it likes. It has clover-shaped leaves and old rose flowers of unique shape.

Wistaria.—Wistarias of many hues and forms are domiciled in California and are fully at home; they do not hesitate to envelop tall houses in a wealth of foliage and bloom. The kinds grown are of oriental origin and we err greatly in not growing them more widely in an oriental way, which, by regular pruning and training, displays their falling racemes most effectively. Wistarias, as we grow them, are excellent, however, for heavy summer shade and entrance of winter sunshine over great areas of courts or buildings.

Climbing Roses.—But all the vines above named, taken together, probably do not equal in popularity and delightful service the climbing roses, of which much is said in Chapter XIV. All that has been suggested in the pruning and training of vines applies directly to the treatment of climbing roses, and their success depends largely upon treatment. There are so many climbing roses and they differ so widely in their characters and behaviors cannot be enumerated. Much of the satisfaction in climbing roses depends upon the freedom of their foliage from blighting diseases during nearly the whole of the year. Many roses have such freedom; others seem to be subject to every ill that the rose plant is heir to; others still are healthy and vigorous in one place and not in another. Therefore it becomes desirable for the planter to study the roses he can find growing in his district before making a choice for his house-cover. If he cannot find dependable ones, he should plant twice as many bushes of different kinds as he expects to finally retain; uproot the poor ones and out-train the good ones to occupy wider space. In this way he will free himself from disappointment without losing time in securing that which is good.

PART VI: PLANT PROTECTION.

CHAPTER XXVI.

METHODS AGAINST PLANT PESTS AND DISEASES.

We have comforted the reader thus far with the assurance that there are policies of explanation, concession and reconciliation for all his hardships and difficulties. Now we order him out on the firing line; he has to fight and he must fight wisely and well. Qualification for this is not easy nor hastily acquired. It must be pursued through the manuals on insects, fungous diseases, etc., of which there are several good ones. Fortunately there are also many branches of the public service which may be appealed to for information: the Agricultural Experiment Station at Berkeley, the State Horticultural Commissioner at Sacramento, the County Horticultural Commissioner and the County Farm Adviser at the county seats of most counties, the science teachers in the local high schools—all these will help you to identify insects, blights, mildews, etc., which you may find in your garden and to apply the proper remedies. For knowledge of the character and vulnerability of insects, which are more abundant in every garden than all other forms of life combined, there is fortunately an excellent treatise available free of cost, and every plant-grower should supply himself with it.* With all the help he can get, however, the amateur should never relax the determination to understand the pest and disease problems which arise in his own experience, and should make constant effort, by patient observation, toward that end.

FOR INSECTS, BLIGHTS AND MILDEWS.

It is fortunate for the amateur who usually works on a small area and with many kinds of plants which do not call for large quantities of materials at the same moment, that the manufacture of insecticides and fungicides has been so extended that one can buy preparations in small packages or cans for nearly all the pests and diseases he is likely to encounter. They cost more than home-made stuff, but you save all the time and trouble of cooking and mussing and of getting into mortal combat with the cook. It is fortunate also that you can get simple atomizers, sprayers, dusters, blowers, etc., for the application of liquids or powders for different kinds of insects or fungi, and they are inexpensive and light in weight, so that any one can use them effectively. All the catalogues of California seedsmen offer such materials and appliances, and the amateur should have a war-cabinet in his tool

*"Injurious and Beneficial Insects of California," 1915; by E. O. Essig—to be had by application to State Commissioner of Horticulture, Sacramento.

house, where such things are kept always ready for use. Formerly one had to spoil his temper and his clothes and be late for church in making and applying some mess to a plant, while now he can saunter into the garden after breakfast, spy a new pest, take a shot at it with the proper ammunition and artillery, get to church early and enjoy the sermon because he knows that he has put satan behind him. The trade has certainly done great things for the amateur. But though the problem of insecticides and fungicides has been thus simplified for the amateur, it may be helpful to readers remote from the shops to indicate a few first aids to the injured.

A Universal Contact Insecticide.—Kerosene, emulsified so that its injury to living plants is obviated, is almost a universal garden insect destroyer. No matter what kind of an insect it is, if you can get kerosene emulsion against the breathing port-holes, which are on the sides of him, his career is ended. The easiest way to make a little kerosene emulsion is this:

Dissolve a 1-inch cube of laundry soap in 1 pint of hot water; add 1 pine of kerosene. Churn with egg beater until the mixture looks like clabbered milk. For growing plants, dilute with water to 2 or 3 gallons; for dormant hard-wood plants, 1 gallon.

Another widely useful contact insecticide is tobacco solution. It can be made by pouring five gallons of boiling water over a bushel of tobacco stems, and after cooling pour off the liquid and add five gallons of water. This tobacco tea should be used as soon after making as possible and is of little value if allowed to stand two or three days, for it will start to ferment and it then loses strength. The most convenient form to use is the nicotine extract. Use one tablespoonful of the nicotine to five gallons of water.

A simple soap solution is effective against plant lice if thoroughly applied several times so as to kill new comers or refugees from earlier treatments. Use an ordinary cake of laundry soap to five gallons of warm water. Cut the soap in small pieces to secure quicker solution.

Garden Fungicides.—Most mildews are checked by freely dusting the plants with very finely-ground or sublimed sulphur. The ordinary commercial sulphur is too coarse to be highly effective. The sulphur can be blown from a dust-sprayer or shaken from a cheese-cloth bag fastened to the end of a stick.

The copper-fungicides used in orchards are effective against fungi affecting garden plants, but the blue-whitewash effects are unhandsome. A fungicide which does not discolor foliage is this:

Potassium sulphide, 3 ozs.; water, 10 gals. This dissolves immediately, making a clear, yellowish liquid. The fierce odor of it is not enduring. Frequent applications have to be made to cover newly-grown foliage.

SLUGS, SNAILS AND SOWBUGS.

Garden snails are exceedingly difficult to destroy. Sprinkling powdered lime on the infested ground around the plants destroys many of them. Some people protect choice plants by hand picking of snails after dark, using a lantern to discover them. The best way of all, however, to reduce the bad effects of snails is to keep the surface of the ground cultivated as much as possible during the rainy season. This gives the surface an opportunity to become dry, although the ground beneath will be moist, and snails cannot make any headway upon a dry, pulverized surface.

Some resort to trapping; small pieces of board placed upon the ground surface under which the snails collect in considerable numbers, and they can be crushed on these boards, or fed to chickens or otherwise disposed of. Some success is occasionally reported with poisoning—using cabbage or lettuce leaves dipped in water in which Paris green is thoroughly stirred, one ounce to five gallons, dipping before the poison has a chance to settle to the bottom, and placing these poisoned leaves on the ground near the plants.

When the rains are frequent and the ground kept constantly moist upon the surface, it is almost impossible to check them. A very good way is to have a brood of young chickens or young ducks, with a hen in a coop, and allow them to run in the garden. Ducks are the best hunters for slugs that we know of.

GOPHERS AND MOLES.

These subterranean excavators must be mastered. Suggestions for their exclusion from precious areas are given on pages 151 and 190, but extermination must be always in mind. Gophers eat plants; moles eat ground grubs, worms, etc., but in getting them they wreck a garden bed; therefore both must be killed.

Moles.—If you find large mounds of dirt thrown out freely, but never see an open hole or a prospecting varmint, you may conclude that you have to deal with moles and not gophers. The best thing then is to get a mole trap, which is placed near where the mole is working in such a way that his pushing out dirt sets off the trap, which, by means of a strong spring, shoots sharp spikes through the dirt into the mole below. It takes a little practice to place the trap just right, but it works well when you learn this. We have driven away moles by using a squirrel smoker, which forces into the runway smoke from damp straw and sulphur burning in the machine. We have killed them by watching for the movement of the earth as they are extending their surface burrows and striking in hard with a hatchet. If the ground is soft, they can be thrown out with a spading fork and killed on the surface.

Gophers.—If you find similar mounds of dirt, but find also open holes from time to time, or if the mound has a central depression evidently plugged up with dirt from below, or if you see the beast reaching out of the hole to see which way to go to reach the next plant, then you have to deal with a gopher. Gophers can be poisoned by taking pieces of carrot, potato or apple, a prune or a raisin. Make an incision in each and slip in a crystal of strychnia sulphate. Be sure to get it well down into the burrow and then cover the opening with a sod or a clod and dirt enough to exclude the light. If the beast sees the light he is apt to push a lot of dirt ahead of him and thus cover or throw out the bait. This must be watched, for the poisoned fruit may attract a child or a chicken.

There are several good gopher traps on the market and they are all successful if one places them aright in a lower or permanent runway and not in one of the tunnels which the gopher makes to the surface to get rid of the dirt, for surface feeding or for the enjoyment of the landscape. These surface runs are often abandoned or are plugged up with waste dirt which springs the trap in advance of his reaching that point.

Gophers are also successfully killed by the use of carbon bisulphide, with a suitable pump to force the fumes into a branch of the permanent lower run-way, or by quickly using a surface tunnel which shows fresh dirt, thus finding a way open to the main tunnel before the beast has time to close it below. Sometimes one will have to deal with a wise old gopher who disdains poison or traps, and such a one we usually get with a shot gun when he is prospecting from an open hole.

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